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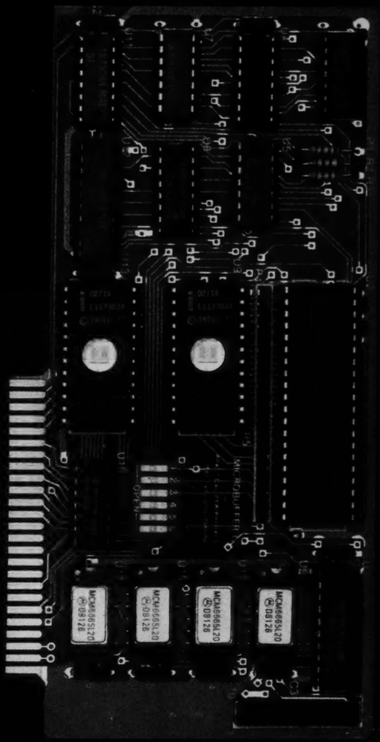

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This juggler was among the marvels of computer graphics viewed by visitors to Siggraph '81. See page 86 for a full report by Ted Nelson. (Reprinted by permission of Information International, Inc., copyright 1981. All rights reserved.)

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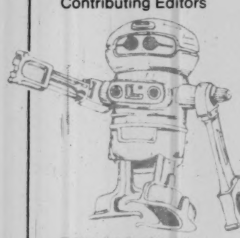

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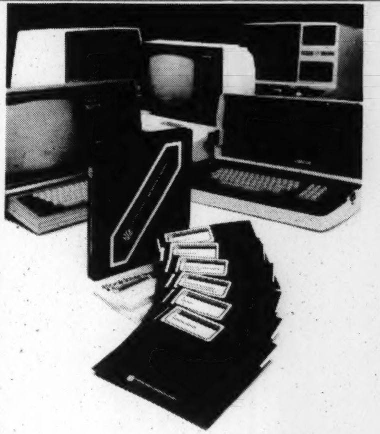

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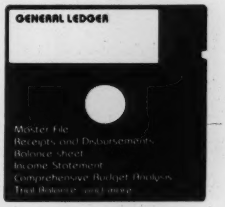
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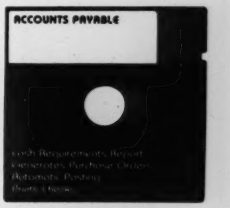
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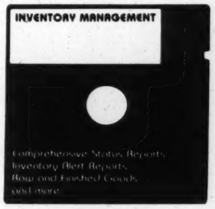
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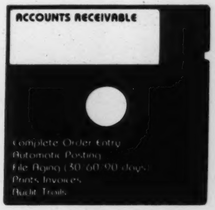
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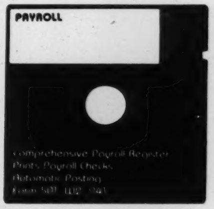
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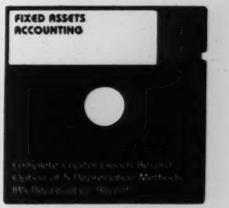
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utput...input/output...input

Hand to Hand Wombat

Dear Editor:

Michael Potts's program ("Wombats," p. 216, Oct. '81) is very special! In the process of entering it I have been able to sharpen my typing skills quite a bit. He notes that it is written for 16K (and up) Model I TRS-80, and since my system is 48K disk, without lower case, some simple modifications were needed.

Additionally, some problems came up with features which didn't function as it seemed they should have. The following comments may help others who have tried this program which does have a lot of appeal to the otherwise unattentive student.

Line #	Comment
110	To avoid an overflow in statement 3400, add :IF NMX>443 THEN PRINT"443 is the maximum. Try again!":GOTO110

Also, if the PRINT before the INPUT in that line is changed to a PRINT@384,"" then the thing doesn't scroll off the screen when you respond to the "object" requests in line 120.

212	Since this line refers to line 216, and there is no 216, 212 should be deleted and :GOTO210 added to 214 in place of the :STOP.
1190	Change IFNQ=NOTHEN..... to either IFNO= NQTHEN.... or IF(NQ=NO)THEN.... as the NO THEN doesn't get interpreted correctly (the NOThen may be the problem).
1725	Change to I$="":I$=INKEY$:I%=I%+1:IFI%> 100THEN1740 ELSE IF(I$ <>"P")*(I$<>"Q") THEN1725.
1727	Delete ..
1730	Delete ..
1733	Delete ..
1780	Change to NR=NR+1:PRINTSTRING$(50,61): IFI$="Q"THEN1970ELSE200

The above changes to lines 1725-1780 were necessary for me to get the "Inventory" portion of this program to function properly.

Several other changes which have been made to my listing, but aren't necessary for actual operation, include:

Line #	Comment
280	Insert K9=0: at the beginning of the statement and change GOSUB1700 to GOTO1700.
1023	Insert K9=K9+1:IFK9 3THENPRINT" Three unassisted trys are the limit!": GOTO1030 ELSE at the beginning of the line.
90	The CLEAR statement needs only 1000 as over 30 exercises built the string space to only 840.
1840	Change "gotten" to "made." "Gotten" just bugs me!
1850	Change the limit for the superlative "very" to 94 College standard!
1890	Change the Input variable to S9, so as not to mess up I$.
1970	Change the NT=NR to NT=NR-1. This makes the inventory list come out with the proper number of examples.
3120	Add :GOTO3150.

I'm not sure I agree with the comment about students not liking tests, since computer games of skill seem to sell pretty well, and some of them are little more than tests with sparse feedback.

My wife is a teacher and uses our computer to tutor primary grade children who have difficulty with some subject or other. Her success rate has been astounding, judging by the results the students show in classroom improvement. "Wombats" is a very helpful addition to the tools she uses.

Jon M. Rueck, P.E.
103 Sage Road
Silver Lake, KS 66539

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GRM of an Idea

Dear Editor:

Pertaining to your review of VisiPlot (12/81) and the slowness of entering data with VisiCalc, you can set recalculation to occur manually or automatically by using the /GRM and /GRA commands. Once set to manual, recalculation can be triggered by keying in an exclamation point.

This is thoroughly covered in the 16-sector manual on pages 2-78 and 2-79 (Lesson 4), and on page 3-26 (Command Reference Section). And the reference card covers it briefly. The information is also given on the reference card and on page 4-10 of the 13-sector manual (no command reference section in that one).

The other problem area you mentioned was printing. You left an incorrect impression about VisiCalc when you stated that the program does not take advantage of buffers or built-in intelligence. I have a Comet 8300P printer at home, and an IDS 560 at work.

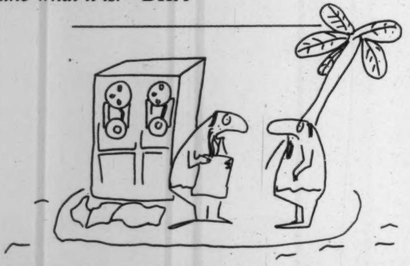
Both of these printers work bidirectionally with VisiCalc, and each does a full page in 90 seconds or less. Both printers have buffers, and VisiCalc definitely uses them. The IDS 560 will print for a full 20 seconds or more after using CTRL-C to stop a printout. In addition, the short-line-seeking logic works fine, and no empty spaces are printed. You probably had a setup problem—your interface card may have needed dip-switch resetting.

Reed Jenney
525 Clark Court
Los Altos, CA 94022

Several comments. First, this was a review of VisiPlot and VisiTrend and I mentioned VisiCalc only incidentally. Creative Computing *carried an in-depth review of VisiCalc in June 1980.*

You are correct about the recalculation feature. However, in my application, I wanted to see the new percentages and subtotals as I went along so I elected not to use later recalculation.

With respect to the printer, we have had no trouble with bi-directional printing with the Apple, however, with the TRS-80 Model III, the Diablo printer works fine (fast, bi-directional) with Scripsit, but not with VisiCalc. There may be a fix but three reasonably competent people have not been able to determine what it is.—DHA



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"We might as well build the raft next. According to this, there isn't a ship anywhere in the vicinity."

Grade Expectations

Dear Editor:

Many thanks for printing W. Teoh's Grades program in your October issue. Since we are both college teachers, my wife and I purchased our Apple computer two months ago with the hope that it would prove to be a timesaver. We have both used Grades and have found it easy to use and flexible, and it has significantly reduced the recordkeeping chores for our larger classes.

By the way, anyone using Grades should be aware that Figures 1 and 2 in the article are switched.

William L. Moore, Ph.D.
Associate Professor
Management Sciences Department
California State University, Hayward

Cross Breeding

Dear Editor:

I hope *Creative Computing* continues to print articles such as "Apples Can Blossom Daisies" by Jamie Tietjen in the July 1981 issue. I was looking for a daisy wheel printer for my Apple II and like Tietjen thought the Radio Shack daisy wheel should work on my Apple II. Unlike him, I was unable to try it out. My local Radio Shack Computer Center was less than helpful in the question of connecting their Daisy Wheel Printer II to my Apple (indeed, the impression created was that they cared little whether or not they sold me the printer since I did not have a TRS-80).

There appears to be an error in Figure 1 of the article. This figure indicates connecting, via an SPDT switch, Pin 9 of the Centronics Amphenol Connector to Pin 17 of the Apple Parallel Printer Card or Ground (Pins 15 or 18 of the Centronics Amphenol Connector).

According to the Radio Shack interface connector data supplied with the Daisy Wheel Printer II, Pin 18 is +5V DC and not ground.

Also, as a point of interest, the Apple Centronics cable is supplied with the Apple Parallel Printer Card Pin 2 (BUSY) connected to Pin 10 of the Centronics Amphenol Connector (the same connection is shown in the Apple Parallel Printer Card manual). Tietjen correctly shows this as being connected to Pin 11.

One final comment: Tietjen comments that his switch solution results in the switch being closer to the printer than to the computer (the implication being that this is possibly undesirable). By cutting into the DP7(MSB) line closer to the computer and using a longer wire to reach the Centronics Amphenol Connector, the switch can be as close to the computer as you wish.

Alan Westwell
23 Weeks Ave.
Trenton, Ontario
K8V 1X4
Canada

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CIRCLE 110 ON READER SERVICE CARD

Hooked on Fission

Dear Editor:

As a new user of a Tektronix 4050 Series Graphics Computing System, I was looking for an interesting program that could be adapted to the 4050 System and help me develop some skill in using the graphics capabilities available.

I was drawn to the December 1980 issue of *Creative Computing* and especially intrigued with the article by Stephen R. Berggren on his nuclear power plant simulator. This seemed like the best place to sharpen my skills in Basic, since I needed to convert from working in Fortran, while trying to understand the 4050 graphics.

The particular attraction to the nuclear power plant simulation was its technical nature. There has been considerable social attention given to the use of nuclear reactors, and it looked operationally challenging from the brief description given.

Since the Applesoft dialect of Basic is less formal than the 4050 Series Basic, there was quite a bit of translation required. All variables were converted to the more primitive single alpha character followed by a numeral.

All statements were entered on their own numbered line. I laid the Apple graphics out by hand to see what the picture looked like; then drew a higher resolution version of the plant schematic taking advantage of this system's high speed capabilities. (See diagram.)

In what seemed like a painful undertaking, I reproduced the program as listed in *Creative Computing* and operated it as shown in the example to convince myself that it was working as designed. Now it was time for the 4050 conversion.

A graphic header with giant N P P letters introduces the simulation. To add some variety, the user's request to operate is occasionally rejected by the Nuclear Regulatory Commission. The operation of the program now combines the daily status report with the graphic representation of the operating plant. A weekly and monthly Plant Operation Summary—all graphs—were included.

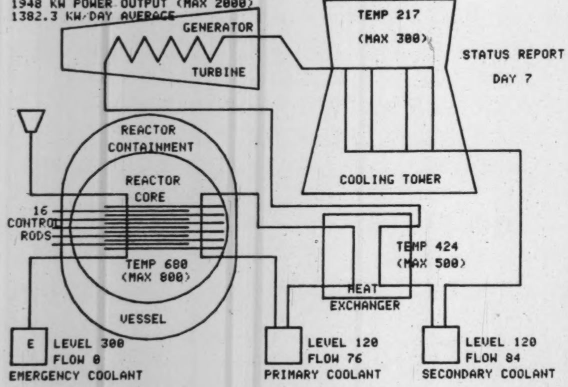
The monthly summary and the end-of-game summary includes a simulation-to-date graph of the daily and average power output. Finally, the meltdown ending displays a disaster area map with the region of contamination shown, when appropriate. The program contains 830 lines of code, just under 20K characters and requires 25K of my 32K machine to run.

If any readers are interested, I will provide a tape copy of the program for the cost of the tape—$35 which includes postage.

Now that this program is running satisfactorily, I can say that my objectives have been met. The 4050 Series dialect of Basic is a more natural language for me as is the graphics software. The simulation has proven to be as challenging as expected and a lot more fun.

Thanks for the opportunity to share my experience.

P.E. Perkins
10295 SW Brookside Ct.
Tigard, OR 97223



Aw, Shoot

Dear Editor:

I currently have a subscription to your magazine, and I think it is one of the best computer-oriented publications on the market. The information you provide is almost always useful, so I don't mind when you occasionally publish an article which is not helpful to me, since, undoubtedly, someone will like it. However, some articles look to me completely pointless. I speak specifically about your article "Home on the Range" in the December 1981 issue of Creative Computing. The article tells how to score the 6th annual Vancouver Island Police Combat Championships. It seems to me that the only people interested in this event are the people involved with it. A game program simulating it might be interesting, but a program which keeps score? I believe that if you take a good look at the article, you will agree. I suggest you also look at the "Comic Relief" article in the same issue.

Your magazine has always been excellent, and I would like it to stay that way.

B. Cohen

We disagree with you on the utility of the Range Scoring Program. As is, it can be used to score other pistol matches. With slight modifications, it can be used to score other sporting events. And lest you think that such scoring is pointless, there is a company in Rialto, CA that makes a successful business of score keeping for distance runners on Apple computers. Quite often, what one person considers useless makes the fortune of another. We try to live up to our name and offer a wide variety of Creative Computing applications.—GB

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CIRCLE 178 ON READER SERVICE CARD

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Computer Swap America

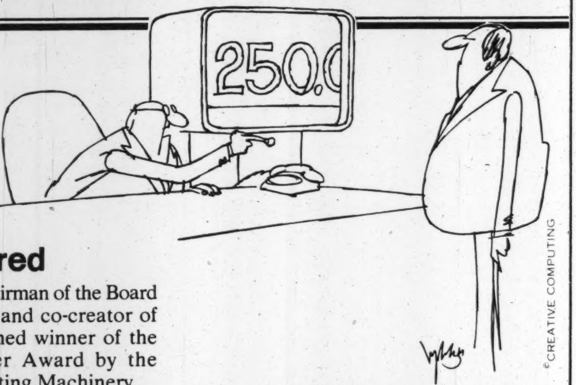
John Craig has announced plans to take Computer Swap America across the country. This will be accomplished by extending the shows to qualified individuals or organizations in various states. Craig will be offering use of the Computer Swap America trademark and a total package which describes co-op advertising and promotion programs and the mechanics of putting on such a show.

Computer Swap America will return to the Bay Area on April 24, 1982 at the Santa Clara County Fairgrounds in San Jose, CA. Hours are from 10:00 a.m. to 6:00 p.m. Admission is $3. For more information, call (415) 494-6862 or write Computer Swap America, P.O. Box 52, Palo Alto, CA 94302.

VisiCalc Creator Honored

Daniel S. Bricklin, Chairman of the Board of Software Arts, Inc., and co-creator of VisiCalc, has been named winner of the Grace Murray Hopper Award by the Association for Computing Machinery.

The prestigious award is given in recognition of major computing achievements made by individuals under 30 years of age. Bricklin and Robert M. Frankston, president of Software Arts, created VisiCalc in 1979. It is the most popular microcomputer program ever developed, having sold over 150,000 copies in less than two years.



"...I can't give you a raise but here's a computer enhancement of your salary..."

Correction

There was a misprint on page 12 of the January, 1982 issue. Line 30 should read:

```
30 FOR M = -32768 TO -32176:PRINT
#1, CHR$(PEEK(M)); :NEXT
```

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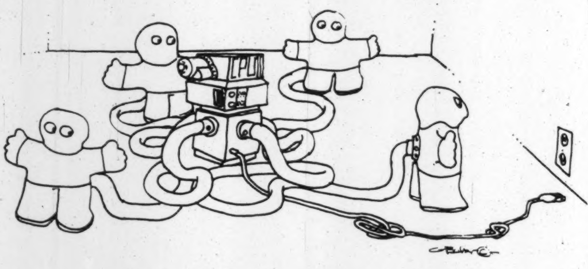

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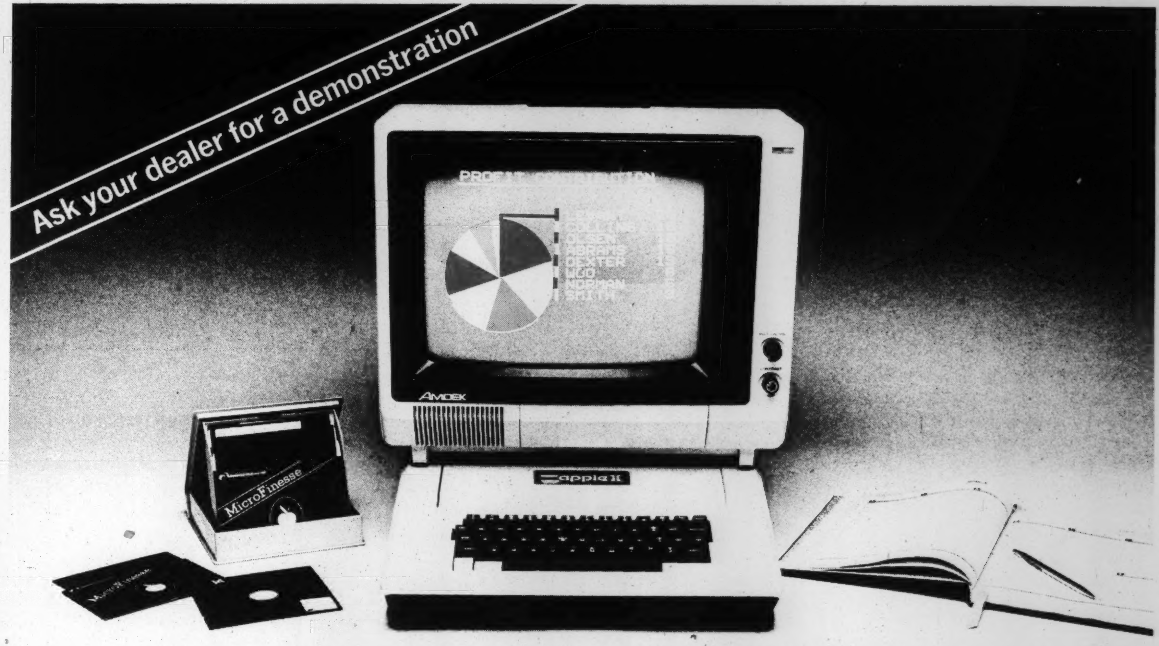

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CIRCLE 217 ON READER SERVICE CARD

Hte Proofreader Porgrams

Stephen Kimmel

No, the title isn't a mistake; it's a joke. Also it's an illustration of a very common error that this group of programs is designed to catch; the simple typographical error. For those of us who are only marginally talented typists, it seems our fingers sometimes don't do what our brains tell them to do. We know that "the" isn't spelled "hte." Our fingers just got a little confused. We're probably the same folks who could never rub our tummies and pat our heads at the same time.

To add insult to injury, our eyes are in on the conspiracy to make us look like fools. If I had put "porgrams" in the text instead of the title, a sizeable percentage of us would never have found it. Add to all of this the fact that, at the end of a long day, even the words you know are right look wrong.

Is there hope for us otherwise intelligent individuals? Are we forever doomed to the mocking laughter of our cohorts when they read our letters? Was all that time spent sleeping in English Composition wasted?

Look! Up in the sky! It's a bird! It's a plane! No, not one, not two, but five spelling programs for the TRS-80. (I don't know if there are analogous programs for the Apple or the Atari other than Spellguard which requires CP/M. Perhaps the presumption is that anyone smart enough to buy an Apple is smart enough to spell.)

Before we get too excited by all of this, allow me to throw a little cold water on the subject. It should be noted that no program available on any machine checks your grammar. (With the possible exception, that is, of the recently announced Grammatik from Soft-Tools. More on this late-breaking development at six.) None of them will be able to tell if you should have said "sale" or "sail." Or even "them" or "then," "win" or "wine," "a cross" or "across."

Consider the difficulty of writing a proofreading program. You can't just say "computer, pick out all the words that aren't right." You have to instruct the computer how to tell if a word is wrong. Consider the title. Everyone would recognize "hte" as a misspelling since "hte" isn't even a legal combination of letters in English. "Porgrams" however, could be a word—perhaps a trade name for a new line of super cheap software. In the context of this magazine, however, and in the common experience of everyone reading it, it almost certainly is an error.

The poor dumb computer doesn't have your experience. So how does it decide whether a word is right or wrong? It checks all the words in a document against a dictionary of several thousand words stored in memory. If the word isn't on the list then it asks (At this level the program becomes so simple that I'm tempted to offer it as a programming exercise.) thus gaining the benefit of your experience. Or at least your ability to look in a bigger dictionary. That's why the size of the dictionary is featured so prominently in the ads for this type of program. The more words it knows, the fewer times it has to ask you.

How many words is enough? Webster's New Collegiate Dictionary contains over 150,000 entries. Few folks, however, know anywhere near that many words. Many secretaries have little books of about 20,000 words. My third novel contained only 4,000 unique words. This article has less than 1,000 unique words. Hence, a program should probably contain, at least, 10,000 words to be adequate, and be able to expand to fit your particular word choice.

Some of the programs seek to expand their effective dictionaries by recognizing suffixes and prefixes. I have mixed feelings about this, since it can get you into trouble. Suppose your program ignores the last letter "s" unless it is "ss." For lots of words this is all right. However "alumnus" would become "alumnu" and incorrectly called wrong while "alumnas" would become "alumna" and called, again incorrectly, right. Words such as "has," "was," "this" and "metropolis" would also fall into the cracks. The results could be disastrous if you were to rely too heavily on the computer.

I suspect that this sort of game could be played for any common prefix or suffix. Name a suffix or prefix and find a word in which that letter combination isn't a prefix or suffix. Would "rely" disappear completely?

The other approach would be to list the legal suffixes and prefixes in the dictionary. That seems awkward and doesn't gain you that much. However, most suffixes and prefixes do follow the rules and this technique does reduce dramatically the number of times a program must stop to check variations on the same word. It won't keep you from having to check the words yourself.

Which brings us to the great Achilles' heel of this sort of program. No group of computer programs illustrates the fallacy of relying on computers more graphically than these. It comes back to the old saw, "garbage in, garbage out." Although I prefer a more current rendition of the same maxim: "A computer can make mistakes in seconds that would take a dozen men days to make."

You see, the computer assumes you know what you are talking about, whether you do or not. If you tell it to spell the word "seperate" "or accross," it will believe you. Your proofreader program will then repeat your mistake with amazing speed. When the program truly fits your vocubulary, it will contain all your own errors and won't be proofreading at all. Further, as you may have deduced, what these programs do is tell you which words to look up in a dictionary. You are paying to have a program tell you which words it thinks you should check. Nothing more. Nothing less.

Thus, this entire class of programs is of rather minimal utility. On the other hand, lots of people like me have problems with simple typos. That's why no fewer than seven of these programs have appeared essentially simultaneously.

I had available to me for this review five of the nine programs of which I am aware. A brief discussion of the missing programs seems in order; prefaced by the comment that I am unqualified to comment extensively, since I haven't actually seen any of the others. Most of this information is derived from manufacturers' advertisements and literature.

The entry of Radio Shack into the proofreading sweepstakes was to be available at the end of November, 1981. Initial

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Stephen Kimmel, 4756 S. Irvington Place, Tulsa, OK 74135.

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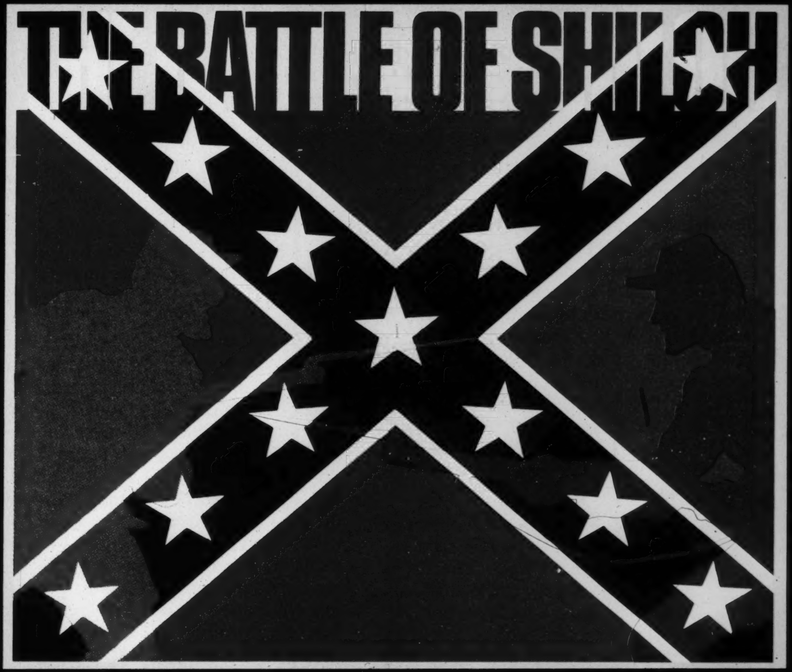

pitting the Confederate Army against Grant's troops and Union gunboats.

THE BATTLE OF THE BULGE:
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CIRCLE 245 ON READER SERVICE CARD

reports are that it has a 30,000 word dictionary on the Model I/III and a 60,000 word dictionary on Model II, and will cost $149. It appears that the Model II version may be worth the effort but that's too much money for the Model I/III. Based on Radio Shack's record, you'll be able to buy it sometime in March, 1982.

Spellguard

A review of Spellguard appeared in the July issue of *Creative*. Advertisements for it claim that it will proofread 10,000 words in one minute. I am somewhat suspicious of that claim. My 48K TRS-80 won't hold 10,000 words (about 60,000 bytes) in a single load. That could be 10,000 very short, essentially all correct words on a multidrive system with a 4Mhz clock CPU. Maybe.

A general comment on speed is in order here. None of the claimed speeds include you looking up any words in an outside dictionary. They tell you how long it will take the program to compare the text to their dictionary. Be aware that it takes longer to proofread a document than they imply, unless the document didn't need proofreading anyway.

Superspell

Also available for CP/M users is a program called Superspell that comes as part of the Select word processing program. An "S" keystroke from within your word processor invokes the proofreader and its 10,000 word dictionary. This program is not cheap at about $395, but then it is a complete word processing package.

Now for the main subject of the review. These are arranged in the order that I received them.

Proofreader

The Soft-Tools Proofreader program is a three-disk package that includes two dictionary disks and the main program disk. It was written by Bruce Wampler in what appears to be Fortran. The approach is as unique as the choice of language. You invoke this program entering "PROOFRDR" from DOS. Proofreader then asks for a file to proofread. It takes your text and creates a list of the unique words in your document. It will check for the word "and " only once.

The program can handle a document of essentially infinite length, as long as there are only 1100 unique words. The list is then sorted and compared to the next disk. The unknown words, which presumably include the misspelled words, are then displayed and/or printed and/or saved to a disk file. To that extent, the operation of the program is very simple and almost bulletproof. The task remains for you to decide if the remaining words are misspelled or simply not included in the 38,000 word dictionary. You have to find them in the text—not a big deal with the automatic search feature of most word processors—and make the changes.

Proofreader makes a single effort at recognizing suffixes. It assumes that a final "s" preceded by a consonant is plural unless that consonant is also an "s." There are very few words for which this isn't true. Typically, these are verb combinations and you won't get into trouble there.

At $54, Proofreader is the least expensive of the group and at the same time contains one of the most extensive dictionaries. The dictionary can be expanded to an additional disk of plain text words. As the documentation states, though, the more extensive the added dictionary, the slower the program will run. For the user who is willing to do a little extra work and who is as tight with his dollars as I, Proofreader is the program of choice.

Soft-Tools, which recently changed its name to Aspen Software Company, has recently announced Proofedit, a program that will make Proofreader interactive with Scripsit. Proofedit will also give the user full ability to add and delete words from the dictionary. Although I haven't seen this combination, it should make the work quite a bit easier for the user. The price for the combined package is just $84.

Soft-Tools has also announced an entirely different sort of program in Grammatik. This program will check punctuation, repeat words and do at least a minimal check on your grammar and style. I'll be doing a more extensive review on Grammatik in another article.

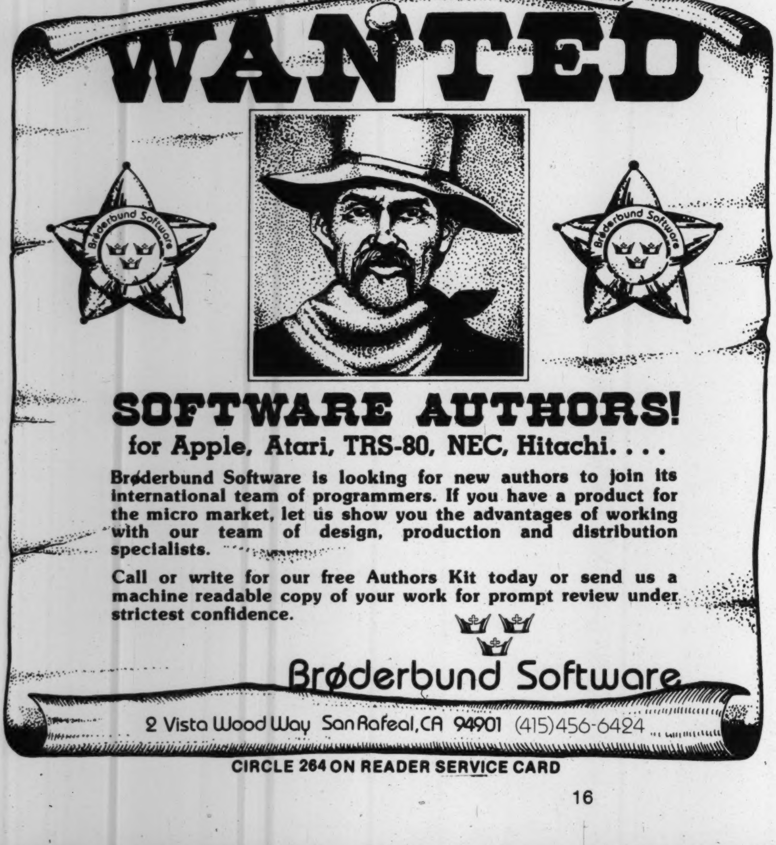
Hexspell

Hexspell by Hexagon Systems requires two disk drives, and they aren't kidding about that. It can, however, be supported on a single double-density disk and an appropriate system. Hexagon reports that sometimes there is excessive disk activity.

It is much easier to run than Proofreader—once you get it running. Because of their scrupulous honesty, their program is one of the hardest to get running. Radio Shack—bless their pointed little heads—told them that they couldn't include even a minimal TRSDOS so they sent out the program with no system at all.

Before you can use this program you have to copy their programs and data files onto a TRSDOS (Or other DOS. Hexspell appears to work with most systems. NEWDOS 80 appears to give it the most trouble) diskette. No fun at all. Surely all those other disk programmers aren't writing their own systems! Kudos to Hexagon Systems for their integrity. A Bronx cheer to Radio Shack for their shortsightedness.

Once you get Hexspell running, it is a pretty spiffy program. Here you begin with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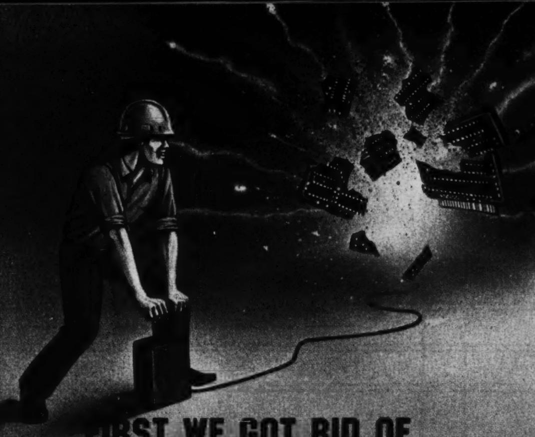

SuperScribe II

FIRST WE GOT RID OF THE LOWER CASE ADAPTER

and put lower case on the screen
WITHOUT HARDWARE.

THEN WE GOT RID OF THE 80 COLUMN BOARD

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WITHOUT HARDWARE.

THEN WE GOT RID OF WASTED EDITING TIME

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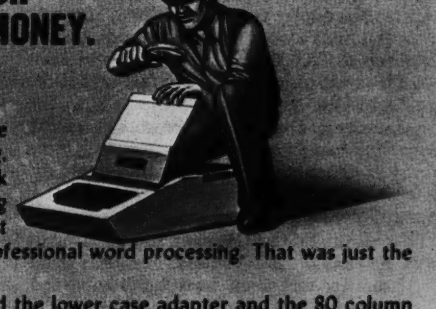

When ON-LINE SYSTEMS began work on SUPERSCRIBE II, we wanted to make it the most powerful word processor on the market. We began by putting in boldfacing, underlining, form letter capabilities, global search and replace, support of multiple disk drives, full macro capabilities, generation of up to four indices, complete formatting capabilities, a software based keyboard buffer, full editing capability of any DOS 3.3 text or binary file (including APPLESOFT programs) and all other features you need for professional word processing. That was just the beginning. . . .

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Proofreading, continued...

Program Name	Proofreader	Hexspell	Microproof	Spellguard
Available From	Aspen Software MHE Box 14 Tijeras, NM 87059	Hexagon Systems Box 397 STN A Vancouver, BC Canada V6C 2N2	Cornucopia Software P.O. Box 5028 Walnut Creek, CA 94596	Pelican Programs 49 Pelican Ct. Syosset, NY 11791
Cost	$54	$69 US	$220 (as reviewed)	$295
Required System	32K - 1 Disk	48K - 2 Disk	32K - 1 Disk	CP/M
Supplied Dictionary Size	38,000 words	10,000 words	50,000 words	20,000 words
Time to Correct this Article	17:35 minutes	32:40 minutes	13:45 minutes	*
Words Questioned	80	212	73	*
Comments	Non-correcting. The user must make changes manually. Least expensive.	Creates file with corrected document.	Automatically corrects original file. Works from within Scripsit.	Reviewed July 1981 *Creative Computing*.

Table of Programs.

"BRUN SP" which starts the Microsoft compiler run module. Again you enter the name of the file you want to proof. The program checks through your document one word at a time, displaying the document as it goes. The chosen speed is about 200 words per minute.

At this pace you should have little problem reading along, and the Evelyn Wood crowd may find it drags a little. This gives Hexspell one of the slowest times of the group.

The display is vaguely similar to Scripsit's. If it finds a word that isn't in its dictionary (up to 28,000 words), it stops and asks. You are shown several words before the word in question and the rest of the sentence. Thus, you see the word in context. You can leave it alone, replace it with a corrected word or add it to the dictionary. A corrected version of the document is automatically saved to the disk.

Actually the program can learn many more than 28,000 words. The file is structured so that when word 28,001 is learned, the least used word is thrown away. The program changes to match your word selection exactly. Hexspell's 28,000 words then are more than adequate. If you have two disk drives and are still tight with your dollars, then Hexspell may be your program.

One brief sour note. If you are running with a lower case modification, then be sure to have a lower case driver working before you run Hexspell. The program doesn't have a driver and has our old friend, the TRS-80 keyboard reverse, working. Any words you replace will be all caps. It might also give you problems cleaning up the dictionary.

Chextext

Chextext from Apparat is a solidly designed program for $79.95. It has a dictionary of 10,000 words which can be expanded up to 50,000—if you have a dual, 80-track disk drive. Presumably it works with NEWDOS 80 to support that kind of equipment. For a $3.00 handling fee, Apparat will send you a 20,000 word dictionary on a diskette that will handle twice the capacity. Chextext needs more diskette for its dictionary, because they haven't encrypted the dictionary. This makes Chextext's dictionary maintenance one of the simplest and most exhaustive around.

You have two choices in using Chextext. You can operate it as a separate program with "CHEXTEXT" or you may use a Scripsit modification routine that is supplied and invoke Chextext from within Scripsit with a "P,CHX" command. The program then begins the usual Scripsit print check. This can be a hassle if you weren't expecting it to find formatting errors. But you have to correct them sometime and it might as well be now.

Then you get into Chextext itself and the program begins to proofread your document to eliminate multiple checks. That finished, it checks the words against the dictionary and saves any unmatched words to an internal "suspect" word list. After all the words are checked you are given the choice of ignoring the word, adding it to the dictionary, marking the word in the document (the last letter is changed to a # sign wherever it occurs) or forgetting the whole thing. If you mark misspelled words it is still incumbent upon you to go through the document using the search and replace option to correct the words.

Operated as a separate program, it is very similar to Proofreader. Everything is menu-driven. It appears that you have to work through the program separately to gain the full advantage of the dictionary maintenance and the other features of the program.

As expected, this is a solid bit of programming with nothing to be said against it. I found only one bug in the program, and it was merely an annoyance rather than a genuine problem. The dictionary is adequate, but there are larger dictionaries available. There are programs available that don't require two disk drives and programs available that work faster. Dictionary maintenance is the strong suit here.

Microproof

The last program to arrive may very well change my mind about the importance of price. At $220, it is the most expensive of the group, but it has the largest dictionary, works the fastest and is the easiest to use. I'm speaking of Microproof by Cornucopia Software. It comes in less expensive configurations. One version that costs $125 works much like Proofreader. For another $60 you can get it to make the corrections as Hexspell does. The final $35 buys you the ability to invoke the proofreader from within Scripsit or Electric Pencil.

The claims for Microproof are, like those of Spellguard, so strong that I was originally tempted to reject them out of hand. The 50,000 word dictionary is the largest claimed by 30%. It is claimed to be infinitely expandable. (Infinite is a whole lot and

	The Word	Chextext	WordSearch	Superspell	MIZ Spell
	Oasis Systems 2765 Reynard Way San Diego, CA 92103	Apparat, Inc. 4401 S. Tamarac Blvd. Denver, CO 80237	KEYbits Inc. P.O. Box 592293 Miami, FL 33159	Select Information 919 Sir Francis Drake Kentfield, CA 94904	Programs Unlimited Dept. 881M Box 265 Jericho, NY 11753
	$75	$79.95	$195	$395, Apple; $595, Z-80	$49.95
	CP/M	48K - 2 Disk	CP/M	CP/M	Model I 48K disk
	45,000 words	10,000 words	8,000 words	20,000 words	18,000 words
	*	21:20 minutes	*	*	*
	*	267 words	*	*	*
	*	Solid, reliable program. Dictionary in ASCII.	*	A full featured word processing program.	*

*Not available for testing.

would probably require an infinite number of disks. I don't have that many.)

It also claims to proofread and correct 10 pages of text (single-spaced pages have about 600 words each) in less than a minute. All this and more on a 32K single 5" disk system? Well, closer examination shows the claim to be for double-spaced pages using the CP/M version of the program. The author, Phil Manfield, admits that the TRS-80 version is much slower.

But it is still fast. And it combines the approaches of the other systems. Integrated with Scripsit or Electric Pencil, the program can be invoked with a single command from within the word processor program.

The first thing the program does is save the text to diskette. It then reads the file back in creating a unique word list as Proofreader does. The program compares the words to the dictionary. The program calls for the appropriate diskette changes so it can work with one disk drive. A list of unknown words which is usually very small is then displayed. Finally, the program will go back through your file, searching for the occurrences of the changed word and makes the changes. If there were words you wanted to see in context they will be shown at this time. I was dazzled by how quickly it worked. Like the others though, it slows down considerably while waiting for me to look through the dictionary to check my spelling.

A dictionary of 50,000 words? All of the programs except Chextext use various systems to encrypt their words and reduce the amount of memory required. Microproof goes further in this reduction than any other. I have no idea if the dictionary actually contains that many words, but there are quite a few words in this article that only Microproof caught. Fifty thousand words may be a bit excessive, but in this type of program it is best to have the largest number of words you can afford.

Microproof does the best job of recognizing the suffixes and prefixes. I think it does this by encoding what type of suffix goes with what type of word. You are given the option of describing a new word as a noun, a verb, an adjective or an adverb. I can think of no other reason for doing this.

So far, I have been unable to find a Microproof claim that didn't appear to be true.

The Test

Proofreader is the cheapest. Microproof the most expensive. Proofreader is the most difficult to use. Microproof is the simplest. This doesn't really begin to give the complete picture of what is happening here, however.

You want something that has an acceptable speed, contains all the words you have doubts about, and most important, will make your life easier. That, after all, is what the computer is all about.

So I ran a test on the programs. How fast do they work? How many times do they stop to ask you what you meant? I chose something available to everyone—this article. I'll leave it to you to judge how representative my word choice is.

I have thrown in a few odd ones just to check the vocabularies. Few people routinely work "kudos" into their daily conversation. This article contains, pending editoral intervention, approximately 3600 words and fills about 16 double-spaced pages or eight single-spaced pages. Excluding the Table of Programs, it contains 942 unique words, counting the intentional misspellings. As such, it is a little longer than most business letters and comparable to most reports.

As I noted before, the time involved in proofreading a document has to include going to the dictionary to check everything out. None of the advertised times include any allowance for this. Yet, if you are like me, you'll end up checking some words that look all right to you. To be fair, I allowed time to check ten words in the dictionary. All of the programs questioned more than ten words so this seemed reasonable to me.

The times required vary considerably, and are shown in the attached tables along with the number of words checked. The results? Microproof was overwhelmingly the fastest, taking less than fourteen minutes to proof and correct the document. Proofreader was quite respectable at seventeen minutes. This was largely due to human shortcuts. Hexspell took quite a while because of the feature which displays words at reading speed.

Recommendations

For the average user—meaning someone who doesn't earn his living writing on his computer—a proofreading program is of minimal value. So if you are going to get one it is best to get the least expensive you can find. The best program in the low price class is Proofreader. It had acceptable speed and the ability to match itself to your vocabulary.

For those who can justify the added expense to go first class, then there simply is no finer program available than Microproof for the TRS-80, Apple or CP/M system. ☐

SuperScribe

A Very Versatile Word Processor

Michael D. Shetter

creative computing

SOFTWARE PROFILE

Name: SuperScribe
Type: Word Processor
System: 48K Apple II or II Plus and one disk drive. DOS 3.2 and 3.3 (requires 3.2 DOS for text files)
Format: Disk
Language: Machine
Summary: Very versatile word processor
Price: $89.95
Manufacturer:

On-Line Systems
3675 Mudge Ranch Rd.
Coarsegold, CA 93614

I purchased my Apple II two years ago primarily for word processing. Since then I've written two books and several articles, all of them using the Apple. During that time I used a popular word processing program and was pleased with it. However, it has some limitations. Because of these limitations I am always on the lookout for new software that will overcome them.

When my Apple isn't being used for word processing it is being used for games. Through the games I came to appreciate the programming of Ken and Roberta Williams of On-Line Systems. So, when On-Line Systems announced their SuperScribe word processor I was interested. When the ads indicated that their system would handle indexes and page headers, one of the big limitations of Supertext II, I decided it was worth a closer look.

This "closer look" proved to be very revealing. SuperScribe is written by Dave Kidwell and distributed by On-Line Systems. To begin with, SuperScribe provides not only complete upper and lower case screen display with no hardware adapter, but the new release provides 70 columns of text without an 80-column board.

Looking first at the upper and lower case: SuperScribe uses hi-res graphics to create high quality upper and lower case characters. In addition, all control characters are displayed on the screen as a squatty character with an underline. With Supertext II, I used both Dan Paymar's lower case adapter and later the Videx Keyboard Enhancer. The SuperScribe display is comparable in quality. The software will also support the shift key modification and there are instructions included on how to install it.

70-Column Display

The new version of the program gives you a second character set which provides a 70-column display without any additional hardware. The 70-column display is easy to read on a monitor. You can see it on a standard TV, but eye strain might prove to be a problem in a short time.

You have the choice of which character set you want to use and you can change back and forth between them as you are working. The screen size you set as you create text will not affect the pre-set print parameters you can use when you print the document.

The real benefit of 70 columns becomes apparent when re-editing text. For example, I usually print a copy of a document, then make my editing notes on that copy. The hard copy uses the margins that will be used in the finished text. When I transfer the changes back to the computer, I am forced to hunt in a 40-column screen for editing changes I have made on the much wider hard copy. With the 70-column character set, I set my line length to the actual line length of the document and the displayed text follows the hard copy, making changes easy.

In comparing the screen display of SuperScribe with a typical 80-column board there is a difference. Most 80-column boards use a 5 x 7 matrix to make up letters. SuperScribe uses a 3 x 7 matrix. As a result some of the letters are difficult to read. "M"s and "N"s are difficult to distinguish from one another. However, generally the display is very acceptable and considering the cost saving, the slight loss in readability is justified.

But, 70 columns and upper and lower case are just the frosting on the literary cake. The basic program has two parts, the "editor" and the "run-off."

The editor will do everything that good word processors do.

Editor

Looking first at the editor, suffice it to say the editor will do everything that good word processors do, including word wrap, search and replace, move, line center, etc., but that's just the start.

The screen is divided into two areas. The top of the screen is where you create your text; the bottom four lines are reserved for information and commands. The information includes the amount of disk memory left, the current tab stops, and the files designated as input file and output file.

From the command line you can execute word processing commands such as search and replacement, save, etc. You can also find out the length of a document in either words or characters. Most of these commands can be accessed from the text modes by using the control key.

Text can be entered in either of two ways. The insert feature allows you to

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Michael D. Shetter, 122 W. South, Geneseo, IL 61265.

enter text by pushing existing text ahead in the document. The change feature lets you overwrite existing text. You can easily switch between change and insert mode.

Before going farther it is necessary to look at the philosophy behind the program. Unlike other word processors that are built to do some things well and others not at all, SuperScribe is capable of doing many things not found in the normal word processor.

The flexibility of the system is limited only by the creativity of the user and his ability to understand the documentation (more on that later). To provide this flexibility there are several commands that can be embedded in the text. These can be embedded by typing the codes as you are creating the text or they can be accessed through SuperScribe's "macro" capability.

Special Functions

This macro feature is very powerful for anyone with unique, but repetitive, writing requirements. Any key or group of keys can be designated with a macro. For example, I press shift/control/P (remember this can be any key or combination of keys that makes sense to *you*) and SuperScribe will print, on the screen, the necessary embedded characters to perform a carriage return and indent for a paragraph.

I use another more complex example of the macro capability for script writing. In writing a script I use a two column format. The right column is the picture, the left for the sound. With the macro, shift/control/V (for visual) I create a print format that sets the margins at 5 and 25, it turns the right justification off, places the text in all caps, and creates a line of text that says "SCENE." I then write the scene description. Then I hit shift/control/S (for sound) and the macro sets the margins at 30 and 70, turns right justification on, allows upper and lower text and creates a text line that says "NARRATION (VOICE OVER)."

This is a great time saver. It allows you

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to establish your own special function keys based on your own logic. For example, if you want a line centered you can establish the center macro to be shift/control/c or whatever makes sense to you.

Indexing

The run-off or print mode has some neat features. True to the advertising, SuperScribe is capable of creating up to four indexes. These indexes are generated as the document is printed. So if you change the number of lines per page or the margins, the page index numbers will change accordingly. You tell SuperScribe the words you want included in each index by surrounding the words with the special characters you designate.

Also in the print mode you can designate up to four titles that will be printed on the top of each page, you have a fifth line that is designated as the date line, and a page header line. These titles, date line, and page line can be turned on and off from embedded commands within the text. From the print mode you set page format, page numbering, number of copies, and justification.

Complete proportional spacing is available.

One comment on page numbering: you can number pages with either Arabic numbers or Roman numerals. All variables such as page number, titles, and dates can be positioned either flush left, flush right or centered, and by line number. All print variables can be changed with embedded commands as the document is being printed.

In the run-off mode there is a text command. This command turns on the 70-column display and displays the text on the screen, exactly as the finished document will look.

Overprint

Another nice feature is overprint. As you are creating text you can surround any word or groups of words with a control/o. When the document is printed, the first time the paper is run through the printer everything except the text surrounded by the control/o is printed. You're then instructed to take the paper back to the beginning. On the second pass only the text surrounded by control/o is printed. This feature is very helpful if you want to switch printing elements many times within a document, such as normal type and italics. If you only have to make the change a few times, the program allows you to place a "pause" code within the text that allows you to change printwheels.

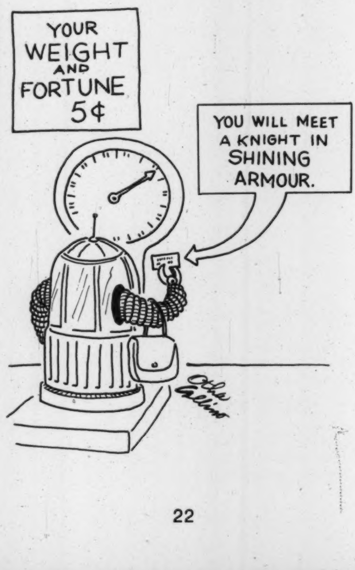
A new feature on the latest release is hyphenation. You set the hyphenation limit—typically five characters from the end of the line. When you are printing in the justified mode and the program senses that it cannot fit a complete word within the justified margin, it gives you the option of hyphenating the word or carrying it to the next line.

Complete proportional spacing is available. You merely indicate the type of printer you are using and the program evens out line length using the capabilities of your printer.

Even with all these features there are still more surprises in SuperScribe, including a form letter capability. You create a file of variables: addresses, names, or whatever you want inserted in the form letter. You then create the letter, indicating what part of the variable file you want inserted and where. Then in the print mode the appropriate elements are merged to create an excellent form letter.

Other nice features include the fact that the system works with standard 3.2 DOS. This allows you to use the word processor to edit Basic programs. You change the program to a text file using a one line addition to your program, load the program into SuperScribe, make changes using the power of the word processor, save the program, then EXEC it back to Basic.

Another advantage of the standard DOS is that you can back-up your program disk. All the files will copy using a standard copy program. The back-up disk will not boot up or run, (because of some alchemy On-Line Systems does to their disks) but, should you bomb the program disk, you can copy the files back onto the program disk where they will work like new. The only protection you don't have is for complete physical destruction of the disk. This is covered by a back-up copy of the program disk available for $5 when you send in your registration card.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Documentation

Naturally all is not perfect. The biggest problem with the program is the documentation. Because of the flexibility of the system, you must understand it in order to use it. The documentation is poor and it takes a great deal of work to figure out what is meant and how it works. A total rewrite with many more examples and a tutorial would help a great deal. (According to On-Line Systems a rewrite is in the works.)

It would also be an advantage if the program also supported 3.3 DOS. SuperScribe will boot on either 3.2 or 3.3 but you must save your text to 3.2. With text processing, the additional capacity of 3.3 would be beneficial.

The biggest problem with the program is the documentation.

The only other problem I had with the program was in working with files larger than memory. The program will work with text files as large as the capacity of the disk. It merely reads and writes material as needed. In some of the early versions of the program there was a bug that caused the system to become "confused"; this has been corrected. The program works well with a 16K RAM card, which allows more of the text to be held in the computer at one time and increases access speed.

One final comment about the program and On-Line Systems. In dealing with software vendors and authors, many times customer support is rather limited. I was, therefore, pleasantly surprised with the help and assistance I received from both Ken Williams and Dave Kidwell. They took the time to listen to my problems and suggested solutions.

One of my basic concerns was how I could convert the 15 disks full of files created with my first word processing program to use with SuperScribe. They discovered a method that does the job without violating anyone's software copyrights.

As it now exists SuperScribe is a flexible and very powerful word processing program. This is especially impressive when you consider the program costs less than $90. ☐

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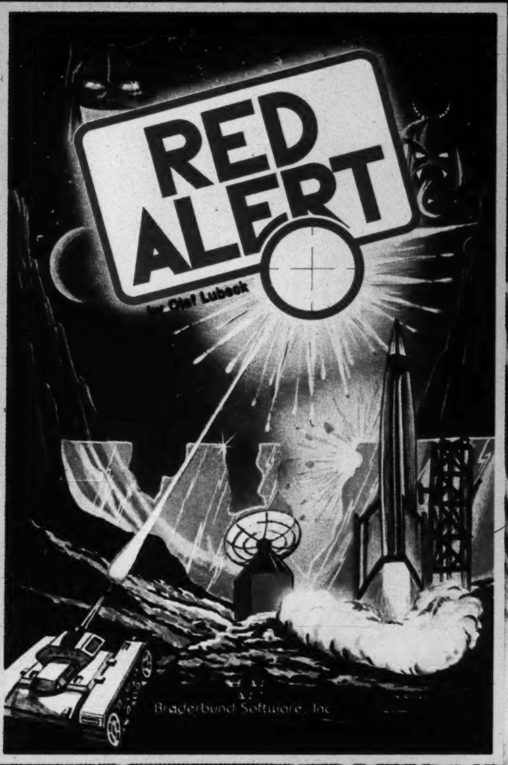
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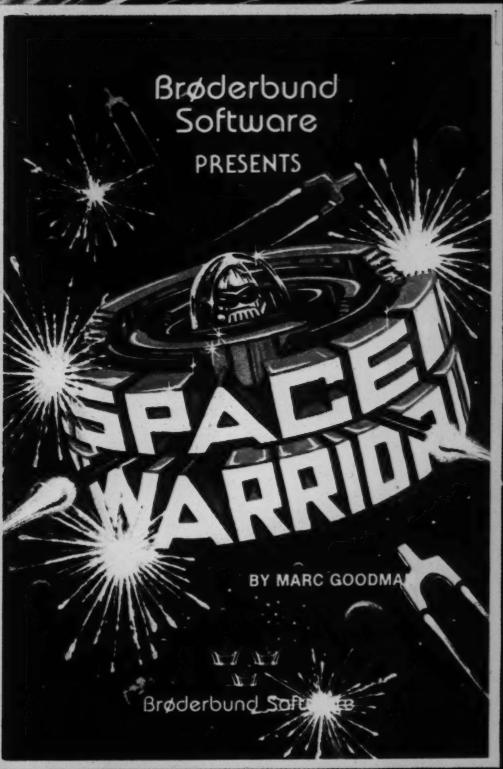
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The Axiom GP-80M Printer

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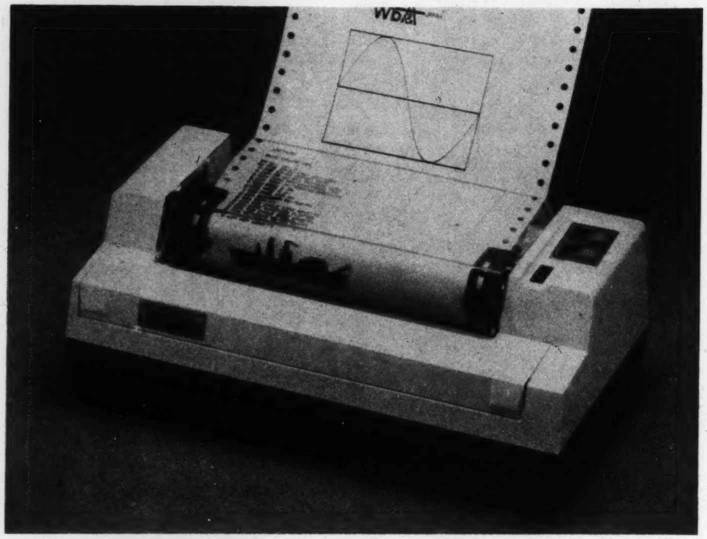


The Little Prints

C. A. Johnson

Less than three years ago, printers were commonly categorized as "over $2000" or "under $2000." With a few exceptions, the $2000 mark separated the dot matrix printers from the daisy wheels.

New developments have brought about significant reductions in the prices of new entries into the market in both dot matrix and daisy wheel designs; however, the dot matrix entries have seen the most startling improvements in their pricing structures. A recent new entry, the Axiom GP-80M, has introduced a new pricing category, "under $400." For the computerist who needs a good utility printer, it is truly a little giant.

Print Quality

The GP-80M is not intended to be a letter quality printer. It is quite adequate for writing letters to your Aunt Maude, the local newspaper editor, or your Congressman, but it is not recommended for submissions of manuscripts to editors of major magazines, such as, *Liberty*, *Collier's* (oops, I am dating myself)—such as, *Cosmopolitan*, *Red Book*, *Playboy*, etc. Those markets, if you are aspiring to become a top professional writer, require that you put your best font forward. For them, stay with your electric typewriter or a daisy wheel printer on your computer.

The Axiom GP-80M is tractor feed, printing 80 columns on 8" paper. It uses a 5 x 7 format, but looks better because it is 12 pitch (12 characters per inch), which brings the dots closer together. Except for the lack of descenders in lower case the type has an appearance similar to some of the 7 x 7 and 9 x 9 dot matrix printers in quality. The lack of descenders on the letters, "g," "p," "q," and "y," gives the print a strange look, at first. However, it is quite readable, and I have not found it to be distracting.

The printing mechanism is, to my knowledge, unique. Instead of a series of wire ends, it uses a single hammer to form the letters, with the hammer making a strike for each dot in each character. The amazing thing about this is that, even with the amount of pounding the hammer must do, it maintains a respectable print speed. It has a uni-directional speed of 30 characters per second, and offers a full 96-character ASCII set (A negative side of this design is the noise level. With the cover off the printer is quite loud. With the cover on, the noise is bearable—DL).

The GP-80M has impressive capabilities. It will print a mixture of double-width and standard size characters on the same line, and can produce surprising graphics.

Documentation

The big disappointment was in the documentation. Like so much of the technical literature being produced, the manual for the GP-80M assumes that the buyer already knows enough to use the printer. The individual who is new to the computer world or who is not technically inclined may have difficulty relating the section on print controls and the binary character chart and figuring out how to use them. In extreme cases, he might never learn how to get the most out of his printer.

It is not that it is difficult to use the controls, it is just that the manual tends to obscure rather than explain them. Without the examples that came with the interface cable, I might still be trying to puzzle it out.

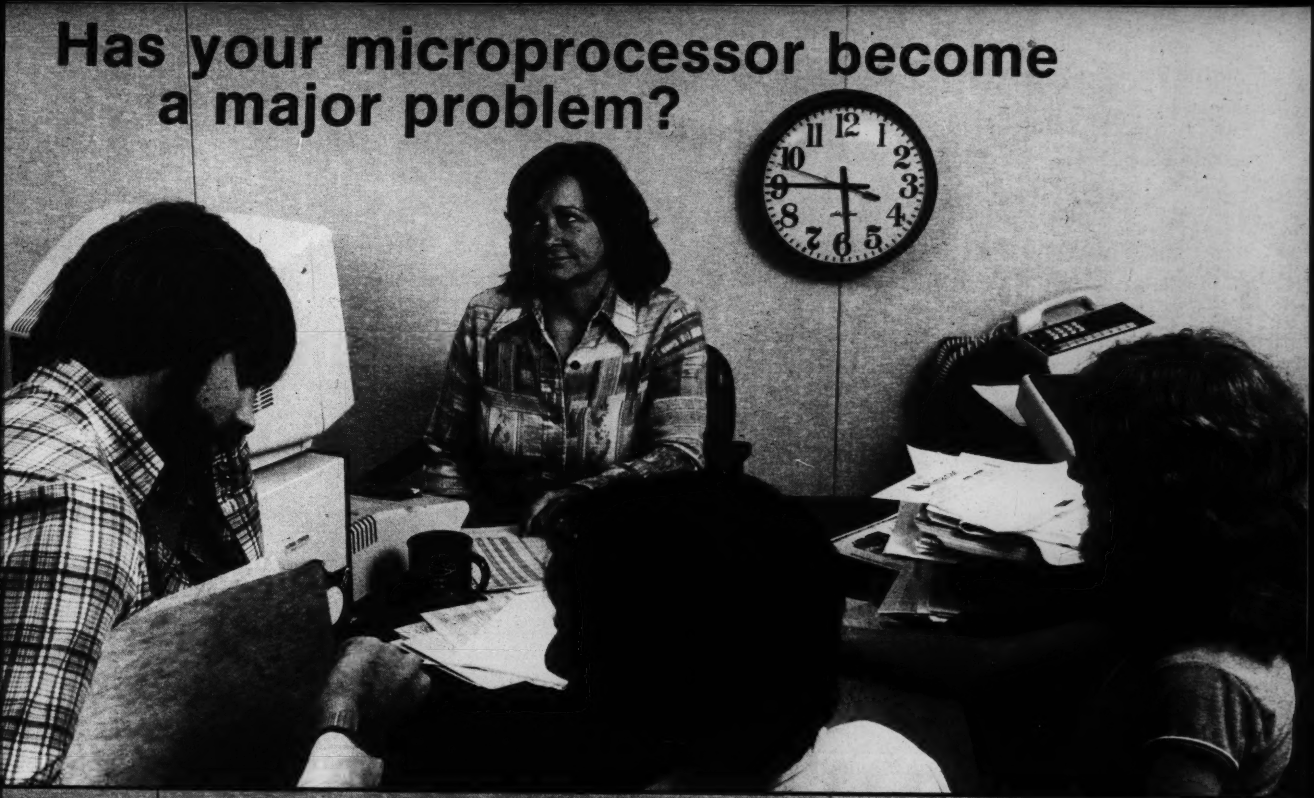
The Self-Test

When you get your GP-80M, I recommend that you do not try the self-test, even though the manual tells you how. You activate the self-test by connecting pin 35 to ground at the cable connector on the back of the printer.

This would be alright, except that pin 36 is the 5-volt power supply for the

---

C. A. Johnson, 3619 Sugarhill Dr., San Antonio, TX 78230.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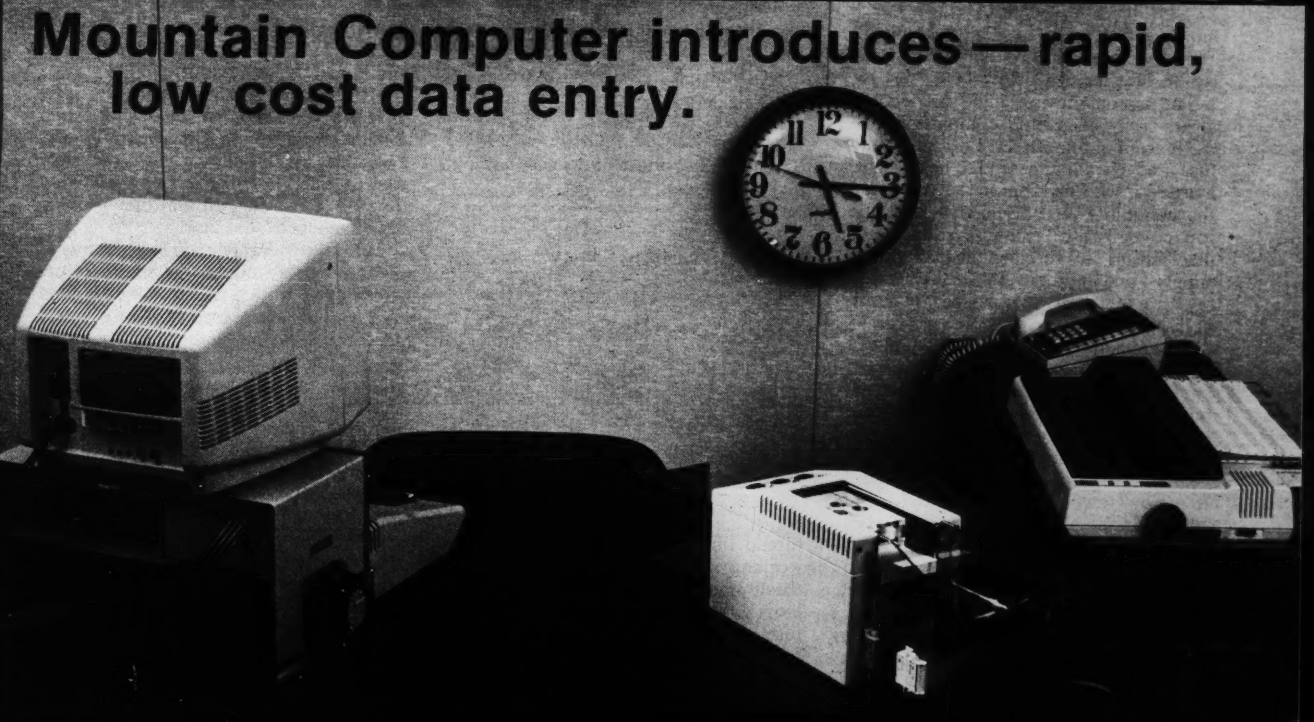
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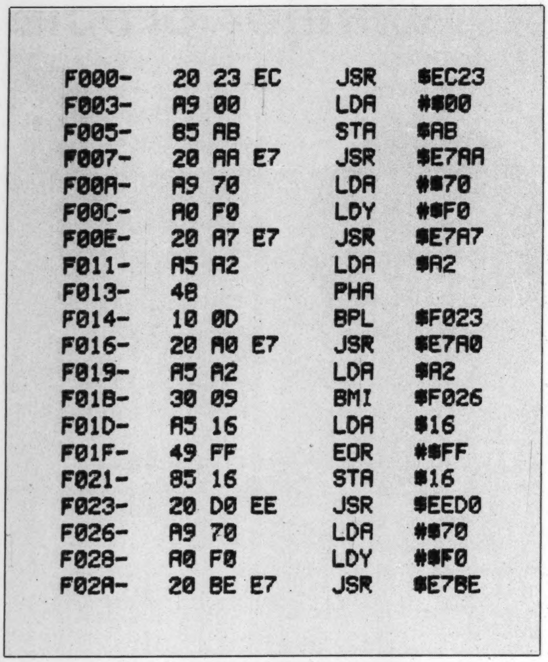
CIRCLE 210 ON READER SERVICE CARD

Print method	Uni-hammer impact dot matrix
Character matrix	5 x 7
Character set	96 upper/lower case, 8-bit ASCII
Character spacing	12 characters/inch
Maximum columns	80
Print speed	30 characters/second
Linefeed spacing	6 lines/inch (character mode) 9 lines/inch (graphics mode)
Paper feed	Pin feed
Paper width	5.4 to 8 inches
Multiple copies	Original plus two
Ribbon	Single color, inked roller built in
Size	12.75" x 6.375" x 5"
Power requirements	117, 220, 240 VAC, 50/60 Hz
Power consumption	15 watts maximum (printing) 5 watts (idling)

Table 1. Specifications.



```
F000-   20 23 EC    JSR   $EC23
F003-   A9 00       LDA   #$00
F005-   85 AB       STA   $AB
F007-   20 AA E7    JSR   $E7AA
F00A-   A9 70       LDA   #$70
F00C-   A0 F0       LDY   #$F0
F00E-   20 A7 E7    JSR   $E7A7
F011-   A5 A2       LDA   $A2
F013-   48          PHA
F014-   10 0D       BPL   $F023
F016-   20 A0 E7    JSR   $E7A0
F019-   A5 A2       LDA   $A2
F01B-   30 09       BMI   $F026
F01D-   A5 16       LDA   $16
F01F-   49 FF       EOR   #$FF
F021-   85 16       STA   $16
F023-   20 D0 EE    JSR   $EED0
F026-   A9 70       LDA   #$70
F028-   A0 F0       LDY   #$F0
F02A-   20 BE E7    JSR   $E7BE
```

Sample printout of a disassembly.

interface board, and is adjacent to pin 35 and very close to it. I tried it and brushed pin 36, blowing the fuse.

The manual shows a single fuse located in an easily accessible compartment in the bottom of the printer. I examined the fuse, and when it appeared to be all right, I tested it with my ohm meter. It passed the continuity test. Stymied, I took the top cover off to examine the printer mechanism. This revealed the main power supply—and another fuse! I tested it with my ohm meter. It, too, passed the continuity test.

I examined the part of the mechanism I could see and looked over the printed circuit boards. I found nothing that looked out of place. The screws holding the print mechanism to the case bottom were visible, but not readily accessible to my straight shafted screw driver, so I did not attempt to remove the bottom of the case. I called Axiom on the phone.

I discussed what I had done and was told that I had, indeed, blown a fuse—a third one at the bottom of the printed circuit board.

Once I knew where to look, I could see the fuse through one of the ventilation slots. It was a simple matter to slip a thin screwdriver through the slot and flip the fuse from its holder. The problem, obviously, was how to insert the replacement. There was no port in the case to give access to it, and I did not want to try to remove the bottom of the case without the proper tools.

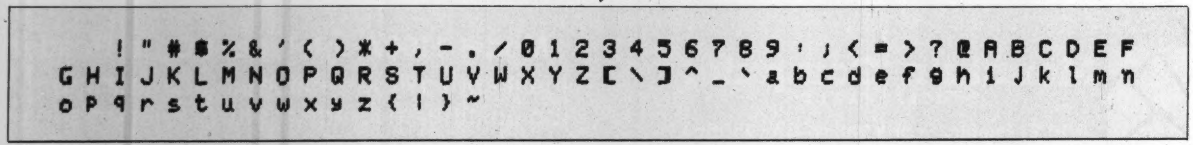
The manual assumes that the buyer already knows enough to use the printer.

I finally solved it by inserting the loop end of a doubled piece of heavily waxed thread through the ventilation slot and working it to a position where I could catch it with a small crochet needle. I looped the thread around the body of the fuse, the wax providing enough stiffness to keep it in place. I then pulled the fuse down into place with the thread, snapped it into place with the thin screwdriver, and pulled the thread out.

I suggest that Axiom remove the reference to self-test from the manual or install a microswitch for that purpose. I would guess that a significant percentage of people who try the self-test as it is now will blow the fuse. I also suggest that they provide easier access to that fuse.

Being a writer, my main interest was to produce draft copies of manuscripts cheaply for editing and to take the load off my daisy wheel printer. As a result, I gave the GP-80M a thorough workout using both Scripsit and Electric Pencil. It worked well with both. Pencil feeds an extra line, but it is easy to set the printer prior to loading Pencil and the text so that it will double space when double space mode is called for by Pencil. Since the printer continues operating in any mode in which it is set until you either change the mode or turn the printer off, a single command is sufficient to set it up. If you wish to make it a relatively permanent change, you can do so by inserting a jumper wire in one of the circuit boards set up for that purpose.

Character set of the GP-80M.



```
   ! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F
 G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a b c d e f g h i j k l m n
 o p q r s t u v w x y z { | } ~
```

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Trial Balance:	Complete transaction detail by account number

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CIRCLE 174 ON READER SERVICE CARD

Little Prints, continued...

For the most part, the printer is perfectly adequate for drafts. It does have a tendency to get "tired" after a long session of continuous printing and occasionally fails to line feed. Ordinarily, I would not be printing 40 or 50 pages at one time, so this is not a serious fault. If I had that much volume, I would get a heavy duty line printer which is designed for that kind of service.

Using my accounting program ("Setting the Records Straight," *Creative Computing*, May 1981), I print the reports I use in the management of my business activities. Since I did my accounting for nearly two years without a printer, my reports were formatted to under 64 columns for screen viewing. The Axiom GP-80M, being an 80-column printer, is ideal for my program.

The printer is perfectly adequate for drafts.

In producing the reports (the journal and balance sheet) the printer performed well, I found the print easy to read. The 8" paper is handy and files easily in a folder, filing cabinet, or notebook.

The Axiom GP-80M is manufactured by Seikosha and is imported and distributed by Axiom Corporation of San Fernando, CA. An interface cable is available for just about any computer you would want to use it with, most notably TRS-80, Apple, and PET. RS-232 and IEEE 488 interfaces are also available. At $399, it is one of the best bargains on the market. ☐

P.S. By the time this article appears, Axiom will have replaced the GP80 printer with the GP100. The differences: the GP100 can use standard fanfold paper, and has a slightly lower list price ($389).

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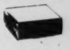

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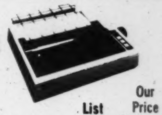

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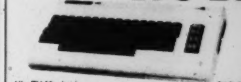

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Missile Command and Asteroids

Atari Arcade Games: The State of the Art

David Small

creative computing
SOFTWARE PROFILE

Name: Asteroids, Missile Command

Type: Arcade games

System: Atari with 16K RAM, joystick(s)

Format: ROM cartridge

Language: Machine Language

Summary: Good versions of popular games.

Price: $39.95 each

Manufacturer:
Atari, Inc.
1265 Borregas Ave.
Sunnyvale, CA 94086

The Atari personal computer has been around for a couple of years now, and some good software is finally being written for it. For some time, the only software available was (usually) either written in Basic and/or translated from some other machine, usually the Apple. None of these programs really took advantage of the capabilities of the Atari.

Now there are quite a few programs available which use the features of the Atari, not just the subset of them required to translate a program from another machine. They use high speed, quality graphics and sound, and were written specifically for the Atari.

This review will cover two of what we consider "State of the Art" game software for the Atari.

They are from Atari Inc., and are clones of the Atari arcade games Asteroids and Missile Command. Not surprisingly, they bear the same names.

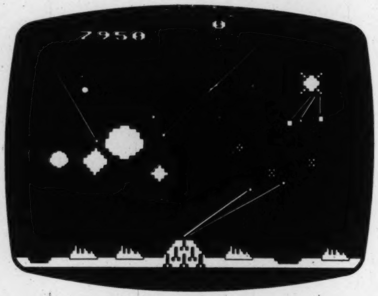
Both are on ROM cartridges which plug into the lefthand slot. Both cost $39.95, and require 16K RAM (no disk needed) and joystick(s).

David Small, 11314 Yucca Dr., Austin, TX 78750.

Missile Command

This is a popular arcade game in which an evil foreign power launches a missile attack against the area you defend. You command anti-ballistic missiles, which you shoot to intercept the incoming missiles, satellites, planes and smart bombs.

In the arcade version, a "trackball" is used to move the cursor for aiming. It allows very high speed movement, and very sensitive positioning. (For example, hitting a "smart missile" exactly on its position is required to destroy it; otherwise the missile dodges). Since no "trackball" exists for the personal computer, a joystick is used.



Missile Command.

Sound effects include an "air raid siren," various explosions, and so forth. They are quite familiar to anyone who has played the arcade game, and make good use of the Atari's capabilities.

Visual effects are also rather well done. There are no longer three missile bases controlled by three buttons, as there are in the arcade version. Instead, there is one, with "underground reloading" which enables it to be destroyed, yet pop up with new missiles a bit later. There are three missile bases in one, all controlled by the joystick button.

The enemy starts with single missiles, moving slowly, then escalates to MIRV's (missiles which break into multiple missiles), satellites and planes (both of which drop missiles), and finally smart bombs which dodge explosions on the way down. Everything begins to move faster, the bombs get more dense, and so forth, until you are finally overwhelmed. As in the arcade version a bonus city is awarded for every 10,000 points.

There are several variations of missile command. An attack consisting solely of smart bombs can be ordered up, if desired, to allow practice with them (a very useful option). There is also a two-player version, and an option to "freeze" the game if you want to get another beer.

Rating

I rated this game the better of the two. It is excellently done with one exception, and that's the joystick handler. I found it very difficult to position the cursor precisely.

The problem is twofold. First, the cursor moves up/down/right/left at the same speed, but moves diagonally as a double increment of up-right, down-left, etc. This makes the diagonal move functionally faster than the others, which makes linear motion darn near impossible. I found myself firing multiple missiles near the same point, and constantly missing. The fine control of the arcade version was missing.

I'm not sure how this could be changed. Perhaps the diagonals could be slowed down a bit and some sort of fine position enabled, with coarse movement occurring a bit later on the same joystick press.

I found the home game just as challenging as the arcade version; my top score seems to be limited by not being able to position the cursor with enough accuracy. (Particularly important with smart bombs.)

Despite my reservations, this is a good game. It's not a replacement for Star Raiders, but it is well done and fun to play. Nor does it get boring after a few turns. I recommend it.

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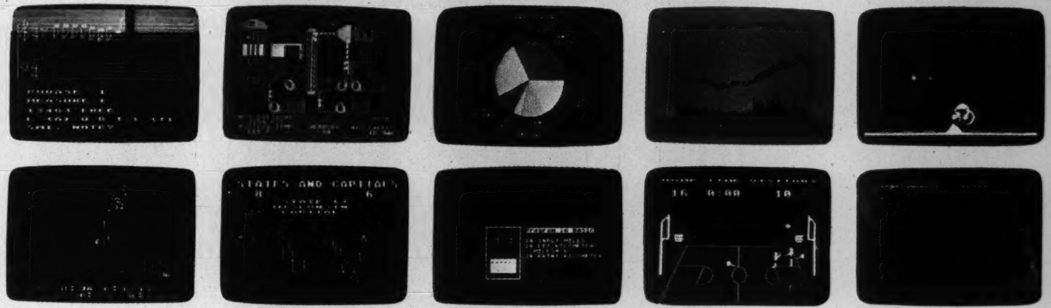

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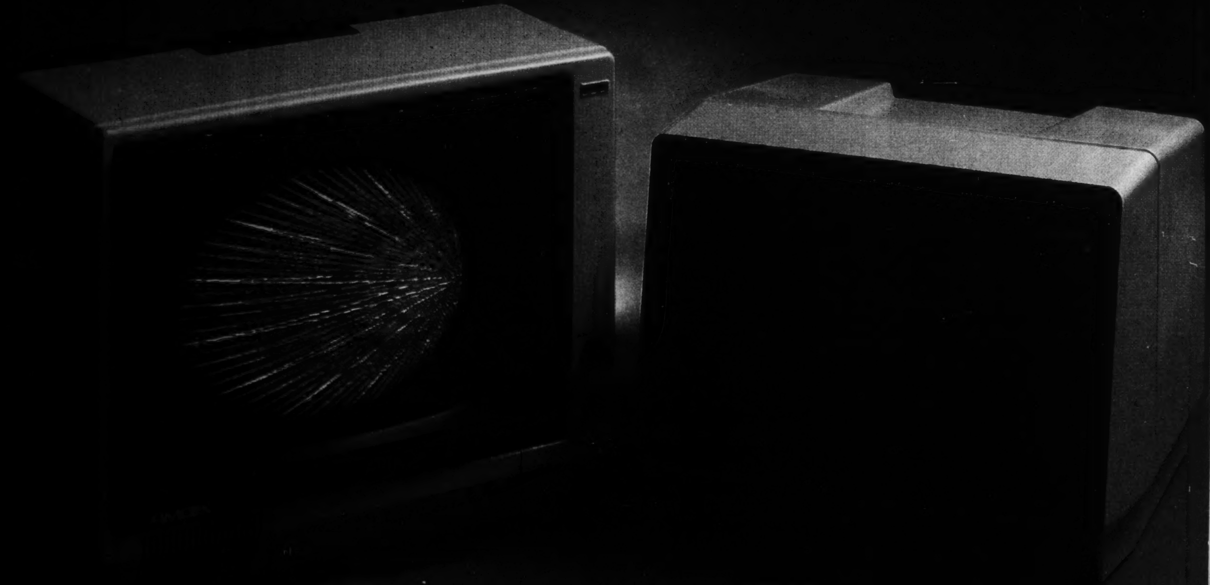

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Atari Games, continued...

Asteroids

As an addict of the arcade version of Asteroids, I really looked forward to this game. I had begun to design an Asteroids game for the Atari (laid out the player shapes and so forth, and had the basic algorithms worked out), but when I heard Atari was releasing a version, I gave up.

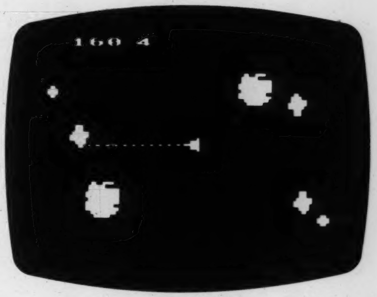
I'm not sure I should have.

Asteroids, as you probably know, is a game which places you in a ship in an asteroid field. You shoot at the asteroids, which break into smaller asteroids, and try to avoid collisions. Occasionally an enemy ship enters the field and fires at you.

This version of Asteroids is apparently written in graphics mode 7 (Basic) or Antic mode 13. This means it has a "chunky" feeling to its graphics. If you have ever played TRS-80 asteroids you know what I'm talking about.

This is particularly surprising when mode 14 is available (graphics 7 1/2) with much better four-color resolution. Indeed, I had planned to use this mode for my version and include three different colors of asteroids. Even graphics 8 (Antic 15) would be a possibility if multicolor asteroids were not required.

Anyway, I find the low resolution look of the asteroids quite annoying. Also irritating is the very large distance between "turn points" on the ship; in other words, a minimum turn is a large distance.



Asteroids.

The missiles are limited to four and probably not done with P-M graphics, as there is an option for up to four players at once. Ah, well.

The joystick is used as follows: right and left are rotate, forward is thrust, back is hyper/flip, your 180 degrees/shields. The shields are not "timed" as in Deluxe Asteroids, by the way, making for a rather predictable game.

Rating

Alas, this one is not as good as Missile Command. I liked it, but not enough, and it could have been done better. Possibly the video game version and this version were made as similar as possible to cut development costs. I can understand the problems, having worked this out myself (for example, how to rotate a rocket in only 8 bits; it looks pretty weird in some angles), but still, much better resolution could have been achieved.

The multi-player option is a lot of fun, and my wife and I spend much time shooting at each other.

One thing you will notice, again, on most Atari games is that they are not CPU bound. On a version written for another machine, there is a very noticeable slowing of the game when there are many asteroids present. This is the result of all the table updating, checking for collisions, and so forth. The Atari version runs at a constant speed, and is fast.

Summary: I play Missile Command much more than Asteroids.

Conclusion

All in all, these were fun games to play. Asteroids will entertain those of you not spoiled by the arcade version, which I admittedly am. It is a good sign that these games exist, as it means that more good software for the Atari is becoming available. ☐

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Cyborg

David Lubar

One of the problems with Adventure games is that the player must communicate with a disembodied "thing." Is this thing the friendly home computer? Is it some spectral guide or fairy godmother? Who knows? Michael Berlyn, writer of the Adventure *Oo-topos* and a published author of science fiction, has done something about this problem. His solution comes in the form of a new Adventure called *Cyborg*. Among other strong points, *Cyborg* takes Adventures out of the puppet league. And it does that very well.

> ***Cyborg takes Adventures out of the puppet league.***

The premise of the game is that the player is a cyborg. This cybernetic organism is part human and part machine. The player communicates with his synthetic half, asks advice on situations and objects, requests scans of items, and in other ways depends on help from his high-tech add-on. Advice, descriptions, help... sounds like an Adventure format. But the player is no longer talking to (or at) some ethereal being. He is being aided by a crucial part of himself (you are not alone). This is an elegant leap in the concept of Adventure games. In essence Berlyn has done for intellectual appeal what Ken Williams did for visual appeal.

This leap alone, of course, is not enough to guarantee a good time. One concept does not make a game, and one good concept does not necessarily result in a great game. Fortunately, *Cyborg* maintains a high level of imagination and elegance. The scenario, the method of play, and the whole feel of the game revolve around the cybernetic concept. I hesitate to give specific examples as that might spoil the mystery and challenge the player faces. The following description is general, and does not contain any hints, peeks, or sneak previews.

creative computing
SOFTWARE PROFILE
Name: Cyborg
Type: Adventure
System: 48K Apple, Applesoft, Disk drive
Format: Disk
Language: Applesoft
Summary: A new wave for text Adventures
Price: $32.95
Manufacturer:
Sentient Software
P.O. Box 4929
Aspen, CO 81612

When the game begins, the player is on a path bordered by a forest. He is informed that he is damaged and that the situation must be taken care of before he loses too much power. The mechanics of the game are the same as those found in most Adventures: two-word commands are used, scenes are described in text, and movement is in terms of compass directions.

At one point in the game, there is a graphic animated sequence, a mini-game of skill and coordination that the player must master. When the player reaches this portion, he should definitely save the game before proceeding. The animated sequence is a guaranteed killer the first time around, partly because of the difficulty of the task, mostly because a few attempts are needed before the player becomes fully acquainted with the mechanics of this portion.

The saving process takes about seventeen seconds. While this might be a long wait for those who are used to instant computer response, it is definitely a time saver when compared to starting fresh. And there are a lot of ways to get killed in *Cyborg*. In some cases, the program allows the player to continue after returning him to a central point. In these cases the player loses any items he may have acquired.

There are two aspects of the game that are slightly annoying. Since it is in Basic, the player must, at times, wait for a response to his input. Also, whenever the player moves to a new location, the disk is accessed. Though this allows for a larger scenario and longer descriptions, it also increases the wait. So *Cyborg* doesn't give the player instantaneous response, but it does offer him a challenging game.

> ***The animated sequence is a guaranteed killer the first time around.***

Challenging? Nearly impossible for the novice, hard for those who are only marginally familiar with Adventures, and potentially tough for those who go through Adventures the way beer drinkers go through pretzels. As with most Adventures, it is linear. Without object A you can't get to location B. In *Cyborg*, object A can be pretty tough to obtain. A solution that seems obvious to one player may never occur to another. This is not a complaint, just a warning to those who are still lost in *Adventureland*. Very few people will get through this game in one sitting.

I really can't say more without giving out hints. It should suffice to say that *Cyborg* is imaginative, tough, and a welcome addition to the world of text Adventures. I can't wait to see what leap in imagination Mr. Berlyn offers next. ☐

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Chromasette Magazine

Owen Linzmayer

Chromasette is a monthly magazine for the TRS-80 Color Computer. Each issue is shipped by First Class mail on a high quality 30-minute cassette and contains six to eight carefully debugged programs.

Chromasette is the sister publication of *Cload* magazine. *Cload* has been supplying ready-to-run programs for Model I and III TRS-80s for over three years. Having purchased past issues of *Cload*, I decided to see what *Chromasette* had to offer to Color Computer owners.

The first issue of *Chromasette*, July 1981, contains six programs written to run under 16K Extended Color Basic. Included with the cassette are five pages of program documentation and various other information.

The documentation/newsletter is written by Dave (no last name given), the editor, in a casual, easy-to-understand fashion. Dave provides detailed explanations of interesting techniques used in the programs.

Let's take a look at the programs themselves in the order that they appear on the tape. The first program on every issue will always be the Cover program.

July's Cover uses hi-res graphics to good effect. The word "*Chromasette*" blinks, spins and bounces up and down the screen at a suprisingly rapid speed. The program is non-ending and pauses only occasionally to display the copyright notice. The Cover program contains excellent programming examples for those who wish to jazz-up their programming with unique graphic displays. Next in line on the tape is Howfar.

Howfar made its first appearance in the July 1979 issue of *Cload*. This version has been modified for use on the Color Computer. The program calculates the distance between two points on the earth after you input the corresponding latitudes and longitudes. Although this program has limited usefulness to the average person, it might help a child understand distance, latitude and longitude.

Chromasette
TM

Blockade is a real-time, fast-moving action game in which the players control their "snakes" with either the keyboard or the joysticks. The object is to slink across the play field to hit targets (which are worth 1-9 points). Your snake increases one unit in length for every point scored. This program uses sound and machine language subroutines to create a fun-filled game for all ages.

Program 4, Acumen, is a Tic-Tac-Toe type program in which the players attempt to acquire three words, out of a pack of nine, that have one letter in common. The only Color Computer feature Acumen uses is sound effects. Other than that it is text-oriented. With six levels of difficulty this program can play a game that challenges a wide range of players.

After you rack your brains competing with Acumen, you may be in need of some light humor, which is exactly what Dissertation provides. This program randomly creates nonsense speeches from a huge list of "fifty-cent words." These grammatically correct sentences can be printed out on the printer or screen at various speed settings. Run the program and let it do its stuff, then read the gibberish aloud with whole-hearted seriousness and lo and behold, you have a ready-made political address.

The last of the six programs is Blast. This "shoot-em-up" game requires joysticks and has five levels of play. The players' laser cannons slide up and down the sides of the screen. In between the weapons is a shield which slowly deteriorates as shots hit it. The object is to blow away your opponent's laser tank before he gets you. Although this program uses low-resolution graphics, the novel sound effects and fast pace make for an interesting game.

Chromasette costs $45 for a full year subscription and $25 for a half year. Overseas subscriptions cost an extra $10.

Chromasette Magazine, P.O. Box 1087, Santa Barbara, CA 93102. (805) 936-1066. □

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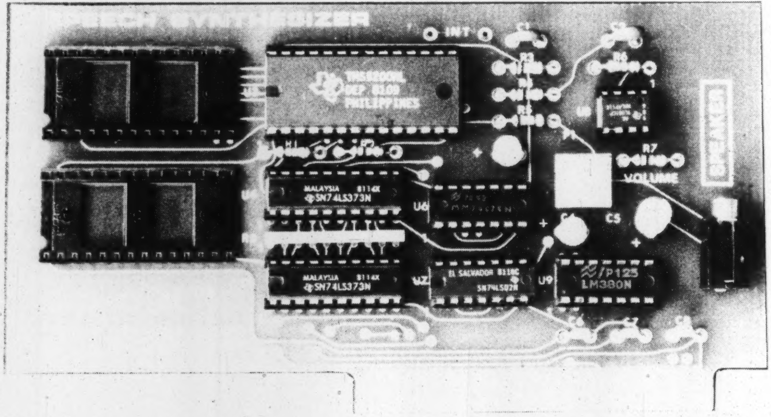

There has been a lot of talk lately—some of it by computers. Now I know that talking computers are not new. What is new, is the technology that lets them talk.

This article is about the Echo speech synthesizer from Street Electronics (3152 E. LaPalma Ave., Suite D, Anaheim, CA 92806.) I'll describe the hardware, software, documentation, and some enhancements for the editor. Finally, I'll review the good and bad features of Echo and discuss future offerings.

Hardware Description

Just what do you get for $225? You get a 6" x 6" x 3.5"speaker, a printed circuit board, a connecting cable (3' long), a 16-page manual, and a 13-sector diskette.

The board is a nicely made double-sided, epoxy laminate of the quality Apple owners have come to expect. It has six integrated circuits in addition to the TMS 5200. There are also a few passive components and a volume preset control. Unfortunately, there was no information on voltage and current requirements included with the unit.

As with most Apple-compatible boards, there are no connections to the computer except through the bus. If you have slot #5 free use it. Although there is a slot finder routine included in the software, using slot #5 can make programming easier under some circumstances. After inserting the board, you attach the speaker wire to the speaker (standard screw driver required) and plug the other end into its jack on the Echo board. That's all there is to installation.

Second in importance only to a piece of hardware that works is a manual that lets you make the hardware work. Manuals are even more important than software. After all, you do program. If the supplied software is not good and the manual is good enough, you can make the software work.

The Echo manual tells you all you need to know. An introduction gives a brief summary of speech synthesis principles. Installation is covered, and the disk-supplied "speech generator" and slot locator program are discussed. Requirements for speaking from an Applesoft program are illustrated with the actual Basic lines, and there is a short description of how Echo creates words from phonemes.

The next seven pages explain how to use the speech editor program. Commands, phrase construction, problem handling, and step-by-step, illustrated examples are all presented. A sample Basic program to speak the phrase created by the speech editor example is listed.

The last two pages list all the words provided in the sample vocabulary and the associated addresses. Figure 1 is the list.

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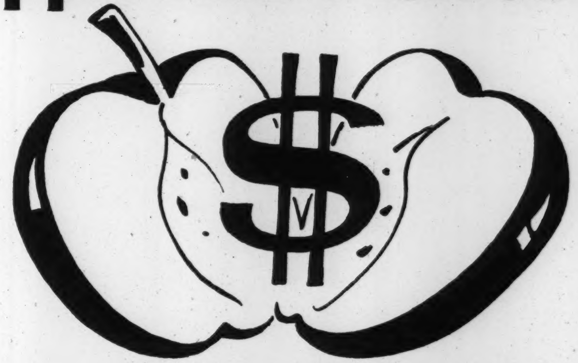

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A	17408
ADD	17417
ADDED	17425
AND	17434
ANSWER	17444
APPLE	17457
B	17469
BLACK	17477
BLUE	17490
BY	17502
BYTE	17510
C	17521
CATALOG	17532
CENTS	17548
CLOSE	17551
COLOR	17570
COMMA	17583
CONTROL	17595
CORRECT	17610
D	17624
DATE	17632
DECIMAL	17641
DELETE	17656
DISK	17670
DIVIDE	17680
DIVIDED	17695
DRIVE	17713
DO	17724
DOLLARS	17732
DON'T	17747
E	17758
EIGHT	17765
EIGHTEEN	17775
EIGHTY	17789
ELEVEN	17800
END	17815
ENTER	17825
EQUALS	17838
ERROR	17851
ESCAPE	17862
EXCLAMATION	17874
F	17899
FALSE	17905
FIFTEEN	17916
FIFTY	17930
FIRST	17942
FILE	17953
FIVE	17965
FORTY	17975
FOUR	17987
FOURTEEN	17997
G	18012
GAME	18020
GOOD	18028
GREEN	18039
GUESS	18048
H	18057
HELLO	18065
HELP	18075
HIGH	18088
HUNDRED	18098
I	18112
IF	18121
IN	18127
INCORRECT	18134
INPUT	18153
INSERT	18168
IS	18184
IT	18190
J	18198
K	18206
KEY	18214
KEYBOARD	18222
L	18236
LEFT	18245
LIST	18256
LOAD	18267
LOW	18279
M	18290
MANY	18301
MEMORY	18314
MILLION	18328
MINUS	18341
MULTIPLY	18355
MULTIPLIED	18376
N	18398
NAME	18409
NEXT	18418
NINE	18431
NINETEEN	18442
NINETY	18462
NO	18480
NOW	18489
NUMBER	18497
O	18510
OFF	18519
ON	18525
ONE	18534
OPEN	18542
OR	18555
OUT	18564
P	18573
PARENTHESIS	18583
PERCENT	18600
PERIOD	18614
PLUS	18627
POUND	18638
PRESS	18648
PRINT	18658
PROGRAM	18670
Q	18685
QUESTION	18697
R	18711
RED	18720
REMOVE	18729
REPEAT	18743
RETURN	18759
RIGHT	18774
S	18785
SAVE	18792
SECOND	18801
SEMICOLON	18814
SEVEN	18835
SEVENTEEN	18845
SEVENTY	18864
SIX	18878
SIXTEEN	18888
SIXTY	18903
SORRY	18915
SPACE	18925
SPELL	18933
START	18942
STOP	18953
SUBTRACT	18964
SUBTRACTED	18979
T	18997
TAPE	19007
THAT	19016
TEN	19025
THE	19033
THE1	19041
THIRTEEN	19047
THIRTY	19060
THIS	19070
THOUSAND	19077
THREE	19089
TIMES	19098
TRY	19109
TRUE	19119
TWELVE	19128
TWENTY	19140
TWO	19151
TYPE	19159
U	19170
UH OH	19181
UNDERSTAND	19190
V	19207
VALUE	19217
W	19231
WAS	19249
WHAT	19258
WHEN	19269
WHERE	19277
WHITE	19285
WHO	19295
WILL	19303
WITH	19311
WRONG	19318
X	19326
Y	19335
YELLOW	19345
YES	19358
YOUR	19366
Z	19377
ZERO	19387
[END OF FILE	19399]

Not a phrase.

Figure 1.

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Software

I found the editor relatively easy to use. Since there are only fourteen commands it isn't a burden to remember them.

There are, however, a few shortcomings. Perhaps the most unpleasant of these is the fact that the editor stops when a file is not found on the disk drive. A simple fix is shown in Figure 2.

Compounding this problem is the fact that when the program is terminated for any reason (even Reset) it cannot be rerun. The slot finder routine bombs. If Echo is installed in slot #5, the simple program modification in Figure 3 will allow the editor to be rerun.

If you are using another slot you must "... POKE 255 into the address which pulls the device select line lo for that slot." See Figure 4 for the addresses. Reset and the sequence INT-FP do not work. Turning off the Apple does work. The company's approach is to "GO 1000." That works, but the header is not printed. Obviously frequent trips to the disk to store phoneme data are a good idea.

```
 12  REM  ****************************************************************
 13  REM  FIGURE 2
 14  REM  ****************************************************************
 15  DATA  4,"WRITE PROTECTED",6,"FILE NOT FOUND",9,"DISK FULL",
    10,"FILE LOCKED",999." "
 16 I = 1
 17  READ EN(I): IF EN(I) = 999 THEN 20
 18  READ ER$(EN(I)):I = I + 1: GOTO 17
 20 D$ =  CHR$ (4)
 25  ONERR  GOTO 20000
```

Figure 2.

Avoiding SLOT FINDER Bug. Insert this line into the Editor program. The program must have been terminated immediately prior to rerunning. If slot #5 is used, then "yes" can always be entered as a response.

```
65 INPUT"HAS THE PROGRAM BEEN PREVIOUSLY RUN";A$:IF LEFT(A $,1)
   ="Y" THEN 80
```

Figure 3.

Echo Enable Address Pokes.

Enable Echo by POKEing 255 into a listed address which corresponds to Echo's Slot.

Slot #	Hex Addresses	Decimal Addresses
1	C090 to C09F	53392 to 53408
2	C0A0 to C0AF	53408 to 53424
3	C0B0 to C0BF	53424 to 53440
4	C0C0 to C0CF	53440 to 53456
5	C0D0 to C0DF	53456 to 53472
6	C0E0 to C0EF	53472 to 53488
7	C0F0 to C0FF	53488 to 53504

Figure 4.

Another shortcoming is that the editor assumes that you have your printer interface card in slot #1. If your printer is in another slot you must change line 7010. Equally as bad, if you fail to load a word from memory or haven't yet started to create a word, line 9040 will give a range error when you ask Echo to speak.

Within the editing process itself there are some areas which could be improved. There is no way to correct a command once it is entered. The entire line must be reentered. The Modify command also requires the entire line to be retyped; it then acts like Insert. A cursor control approach, although more difficult to program, would be a great improvement.

Other features I'd like to see implemented are a memory map function and an auto length function. The memory map function would allow the user to visualize where words are going, check to see if they have been properly concatenated, and help avoid overwriting something important.

The editor tells you the number of bytes used when a phrase is placed in memory.

An acceptable variation would be memory protection so that phrase storage doesn't intrude into DOS or other essential software. The auto length function would improve the procedure for saving phrases to the disk.

As implemented, the editor tells you the number of bytes used when a phrase is placed in memory. When the phrase is saved to disk you must remember how many bytes were required. Perhaps the existing approach is more versatile—you can save partial phrases—but it is more error prone and cumbersome.

Finally, the Delete command deletes just one line at a time. The ability to Delete a range of lines would also be an improvement.

Here are a few hints on using the editor. Save parts of a phrase to the disk frequently. Many editor commands relist all the lines each time they are used. This slows editing down considerably, especially for 30- to 40-line, multi-word phrases. Remember, when concatenating phrases the loaded phrase has a one byte end-of-file marker as the last character. This byte must be overwritten or the remainder of the phrase will not be spoken.

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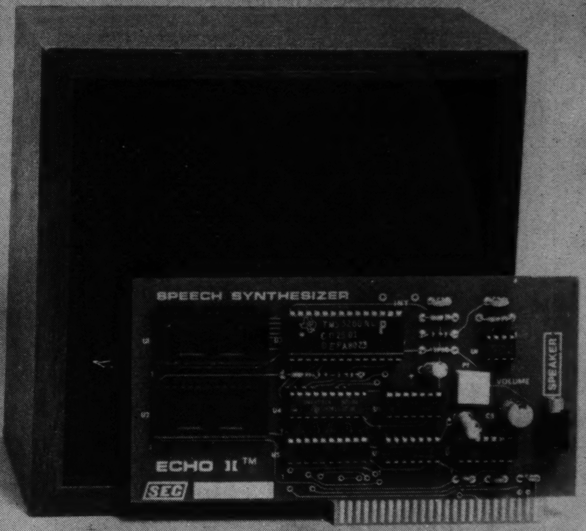

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Table 1. Speech Generator Addresses.

SPEECH GENERATOR.CODE0 - $1C00 TO $1FFF
SPEECH GENERATOR.CODE1 - $3C00 TO $3FFF
SPEECH GENERATOR.CODE2 - $4000 TO $43FF
SPEECH GENERATOR.CODE3 - $6000 TO $63FF

Version	LoByte	HiByte	Speak	Nxtspk	Slot	Setslt
0	7168 $1C00	7169 $1C01	7170 $1C02	7182 $1C0E	7197 $1C1D	8097 $1FA1
1	15360 $3C00	15361 $3C01	15362 $3C02	15374 $3C0F	15389 $3C1D	16289 $3FA1
2	16384 $4000	16385 $4001	16386 $4002	16398 $400E	16413 $401D	17313 $43A1
3	24576 $6000	24577 $6001	24578 $6002	24590 $600E	24605 $601D	25505 $63A1

Good Features

The Echo has many attractive features. The most outstanding of these is its use of RAM. Although the Echo uses Texas Instruments' LPC (Linear Predictive Coding), Street has added a new twist. Phonemes are stored as LPC data. Words are then made up of phonemes. Since the actual phoneme coding is not stored for each word (only the phoneme code address), even less memory is used than would be required in a straight LPC approach. This advantage increases with the number of words which can be stored since there is some overhead. Thus, the more words you use the more efficient it becomes. On the average 10 to 20 bytes are needed per word. With a "rougher" voice even this can be reduced.

Street Electronics is also developing versions of Echo for other computers.

Echo produces highly understandable speech in a neutral voice. It is versatile, and this versatility will be increased by future offerings. When these positive features are compared with its shortcomings, I feel that Echo is clearly a good value.

Future Offerings

There are several future offerings promised for the Echo. Street Electronics will be offering vocabularies in ROM. These will plug right into the onboard sockets. Owners of female computers will be happy to know that female voices will be available, as will an improved male voice.

A Street Electronics developed program which transcribes text into speech is promised, and additional products and services will undoubtedly be made available by other individuals and firms. These are sure to include an improved editor (see sidebar) and operating system, and custom vocabularies, both on disk and in ROM.

Street Electronics is also developing versions of Echo for other computers. There will be a version for the Radio Shack computers called Echo 80, and a general purpose version which uses either an RS-232 serial or Centronics parallel input. This version, to be called Echo GP, is quite sophisticated. It will have its own 6502, phonemes in ROM, ASCII text-to-speech in ROM, an input buffer, and its own power supply.

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Table 2. Sounds With Selectable Variables.

A1 - late	E - speak	M - many	002 - book
A2 - late	EH - letter	N - nice	U1 - tune
AE - dad	ER - hurry	NG - long	U2 - tune
AH - bother	I - finger	01 - oh	UH - fun
AW - call	IU - you	02 - oh	Y - you
	L - like	001 - book	PA1 - pause

B - baby	G - get	R - red	TH1 - then
CH - choose	H - hello	S - see	V - very
D - dog	J - jet	Sh - shoe	W - will
DT - butter	K - kick	T - too	Z - zero
F - if	P - print	TH - think	PA - pause

Table 3. Sounds With Preset Variables.

(A)DD	(END)	(N)EW
(AP)PEND	(I)NSERT	(PR)INT
(C)ATALOG	(L)IST	(SA)VE
(D)ELETE	(LO)AD	(SP)EAK
	(M)ODIFY	(SPM)EMORY

Table 4. Speech Editor Commands.

Echo Update

Street Electronics has recently released the Phoneme Generator, Version 1.0 for the Echo speech synthesizer. This is a software change. No new hardware is involved. Thus, it is completely compatible with all earlier boards.

The biggest improvement in the new version is that words are no longer referenced by memory locations. Words are PRINTed as phoneme strings. This makes it easier to remember what a program is saying. You don't have to make a reference list of words and addresses.

Also, a keyboard editor can be invoked using the "&" vector. Words can be created and spoken from the keyboard, and standard Apple cursor controls are available to edit words.

To use the new software you must first set HIMEM to 35328 then simply BRUN VOICE. Note that you are limited to three disk buffers because Voice occupies space just below DOS. The software locates the Echo card automatically. I have not seen the program "hang" the way the old editor did. Strange output to the generator may produce strange, or more likely, no sounds, but the program returns normally. If no Echo card is installed, output is just ignored. Again, no problem.

To invoke the phoneme generator from a basic program a PRINT statement is executed. The syntax is:

```
5 V$ = CHR$(22)
10 PRINT V$; "string of
                    phoneme code"
```

The phoneme code can be placed in quotes or stored as a string variable.

To invoke the phoneme generator from the command mode type & RETURN. A quotation mark will appear as the prompt. Type a phoneme string and press Return. The phrase will be spoken. To exit the generator, a Return with no preceding character puts you back in Basic. You can jump in and out of the phoneme generator while entering a program without destroying anything. This method of word generation is easy and quick.

The number of available phonemes has also been expanded. There are now ten vowels, six diphthongs, nine "R" colored vowels, eleven voiced consonants, eight stop consonants, five unvoiced fricatives, nine pauses, a schwa and a stop.

Four levels of stress are available, and pitch can be controlled by POKEing 1 to 63 base frequencies (only about 20 are realistic), by specifying 1 to 9 base frequencies within the phoneme string, or by indicating rising, falling, or flat from within the phrase. Even the volume can be controlled from within the phoneme string to a limited extent.

As you can see, there has been a considerable improvement in the software. The ECHO is now a more versatile and easier to use product. There are, however, two potentially negative aspects to the new software.

First is memory allocation. The area just under DOS is not unused territory. For example, the Mountain Hardware clock uses the same area. If your program needs more than three DOS buffers you're also in trouble.

Street Electronics has just come out with a mover program to relocate VOICE. That doesn't help the other memory conflict.VOICE uses a great deal of page 2. Unfortunately, so does the software for several other boards. To solve this conflict one or the other will have to be rewritten. This is a job for a knowledgeable machine language programmer.

The second problem is that VOICE uses the ampersand (&) vector. This special hook is so convenient that other programs (PLE and AMPERSORT are just two good ones) frequently use it. A call to hex 95FD could be used instead, but VOICE must be run first so the other software can set its & vector correctly.

Well there it is. Great new software for a great new product. My six year old enjoys playing with the "puter" and having it talk back. Your programs or games can be made more enjoyable and easier to use with an Echo and Speakeasy phoneme generator software. I can't wait to see what comes next! ☐

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Throughput @80 char./line	76 lines per minute	76 lines per minute	114 lines per minute
Print technique	Bidirectional	Bidirectional	Bidirectional
Dot matrix	9 x 9	9 x 9	9 x 9
Character set	Full 96-character ASCII	Full 96-character ASCII	Full 96-character ASCII
Graphics characters	64 block characters	64 block characters	64 block characters
Interface Centronics 8-bit parallel	Standard	Standard	Standard
RS232C (1200 bps)	Standard	Standard	Standard
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Ribbon	Standard typewriter	Standard typewriter	Standard typewriter
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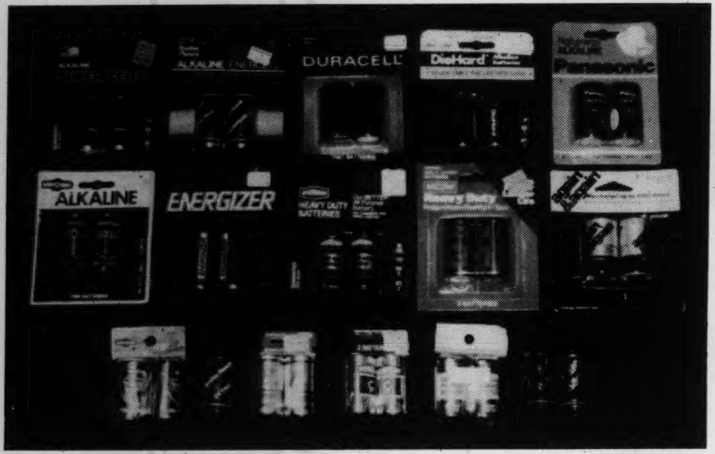

Batteries For Electronic Games

David H. Ahl

"In six months, I spend more on batteries than the game cost in the first place."

"No matter how much I yell and scream, he always forgets to turn it off, and, poof, another set of batteries shot."

"Alkaline, long life, general purpose—they're all the same—they all wear out too soon."

Sound familiar? It's difficult to get along without batteries in this portable electronic age. As a result batteries have become a big business with big ad budgets, lots of hype and not many solid facts.

One maker claims their alkaline battery lasts up to ten times as long as an ordinary battery. Another maker touts the long shelf life of their batteries. Everyone "knows" that alkaline batteries are better and sales figures reflect this bias.

What's the truth? We set out to find out. First we went on a battery shopping spree. Our informal survey of electronic games on the market this holiday season indicated that C-cells were most often required followed by AA, 9-volt and D-cells in that order. Hence, we decided to test C-cells and assume that differences between brands, if any, would hold true for AA, 9-volt and D-cells as well. Furthermore, alkaline cells are the most popular among consumers so we bought seven different brands of alkaline C-cells aong with four "long life" and four standard batteries. We also bought a battery charger and accompanying NiCad cells. In addition, we bought three battery eliminators—two with specific voltages and one "universal" type. And, just to be complete, we bought an inexpensive battery tester.

Test Procedure

The American National Standards Institute (ANSI) has a standard rating system for batteries and the battery industry also has two "standard" tests: "Heavy Intermittent Flashlight Test" and "Light Intermittent Flashlight Test." In our opinion, none of these comes close to approximating the usage one might expect in a typical electronic game. Even in games, the usage will vary widely. In a chess or backgammon game, for example, the batteries are likely to be in operation for relatively long periods (hours, perhaps, in a chess game). In a handheld action game, usage is more likely to be in short 15-minute or half hour bursts.

The life of a battery is quite different if it is in continuous use versus intermittent use because the latter gives it an opportunity to recover between uses. Alkaline batteries tend to have less voltage drop in use than others. Standard carbon/zinc cells have large voltage drops after an hour of use, but also rebound substantially overnight.

Our use test was designed to approximate use of the "average" toy or game. We measured the current drain of six representative games. The range was from 35 ma (milliamperes) to 220 ma with generally an additional 20-30 ma when the device played some sort of tune at the beginning or end of a game. Hence, we used a precision 15-ohm resistor as a load which, across 1.5v, provides a current drain of 100 ma.

While every user is different, we tried to approximate a typical use cycle. Day one, say Christmas, we had one hour continuous use. Day two, one-half hour. Day three (friends came over), two one-half hour uses with 1-1/2 hour recovery between each. Day five through battery rundown, alternate between one and two one-half hour uses per day. The discharge curves for the four battery types are shown in Figure 1. This shows the average voltage in each half hour period of use. Figure 2 is a "close up" of a portion of the curves in Figure 1 which shows the decay and recovery characteristics of the four battery types.

Test Results

We did not run every battery all the way down. Our first one-hour test (Table 1) indicated that batteries within types were roughly similar. Certainly there are differences—the Ray-O-Vac alkaline C-cell had a new load voltage of 1.50v; it dropped to 1.42v after one hour of use and recovered to 1.44v after another hour. In contrast, the corresponding readings for a Duracell were 1.48, 1.38 and 1.41.

However, we elected to run one representative sample from each battery type all the way down. We chose the Panasonic alkaline, Ray-O-Vac heavy duty, Sears general purpose and Gould rechargeable. Figure 1 shows the results of this test. The graph shows the average voltage under load (it does not show recovery time). Figure 2 shows a "closeup" of the first eight hours of use including voltage drop and recovery peaks. Note the much larger voltage variations (use and recovery) in a general purpose battery versus an alkaline cell.

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Clear tabs from one to all.
Set temporary margins (wherever you like) as often as needed.
Repeat all typing keys as needed.
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  Often used phrases (up to 835 characters) in 10 "bins".
  Up to 10 complete forms (tax, medical, insurance, etc.).
  Up to 14,000 characters in an additional 26 "bins*".
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CIRCLE 190 ON READER SERVICE CARD

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Allow insertion of a missing character in an already printed line.
Accept paper up to 17" wide.

Backspace 1/10, 1/12, 1/15 or even 1/60 of an inch.
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Print up to 198 columns.
Do 1/2 line spacing for footnotes and scientific notation.
Accepts carbon film or reusable nylon ribbons.

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Most games give a low battery signal or fail to function correctly when the voltage decreases to about 70-75% of the design voltage. Accordingly, we considered a battery to be dead when its voltage under load dropped to 1.1v. We then calculated the cumulative use time per dollar (average) for each of the four types.

It is apparent from Table 1 that prices vary widely. Two Panasonic C-cells for $1.25 (on sale) are an excellent buy while the regular price of Sears general purpose cells (two for $0.54) has to be considered a bargain. Consequently, although alkaline cells certainly have the longest life, we have derived Table 3 which indicates comparable prices of different types of batteries. One can see from this table that a pair of $2.49 alkaline C-cells is equivalent to $1.34 for heavy duty cells or $1.10 for general purpose ones. Hence, two Sears general purpose cells for $0.54 are equivalent to $1.25 for a pair of alkaline cells.

What About Rechargables?

A word about rechargeables: assuming 1000 recharges as advertised by the manufacturers, they are clearly much better buy than any conventional cells, even including the cost of the charger. We did not check the validity of the claims of 1000 recharges, as that would have taken

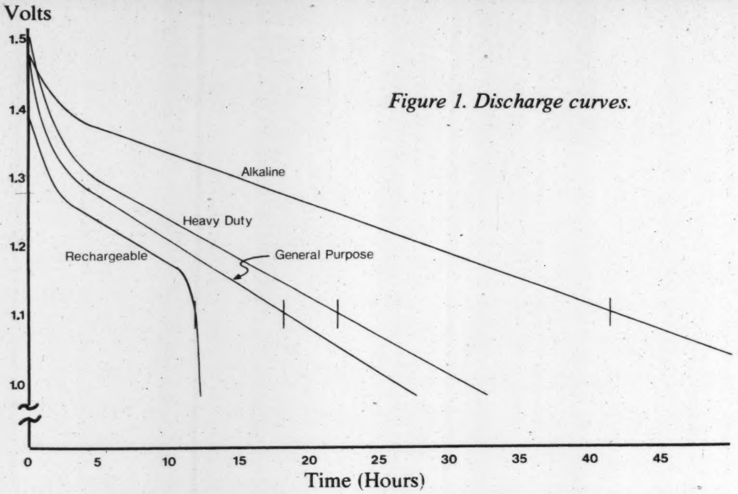
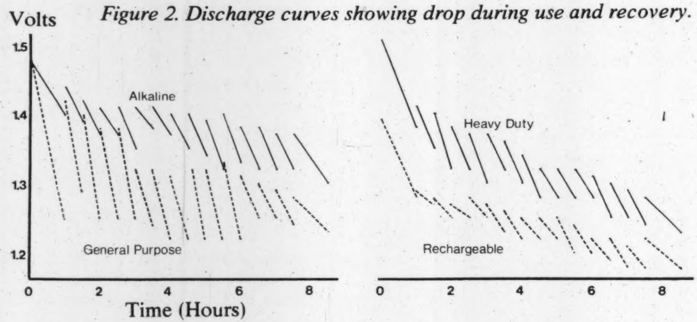


Figure 1. Discharge curves.

Figure 2. Discharge curves showing drop during use and recovery.



Brand	Designation	*Retail Price for Two Cells*	*New-No Load*	*New-100 ma Load*	*After 1 hour Load*	*% of Original*	*After 1 hour Recovery*	*% of Original*
C-Cell Alkaline								
K-Mart	Super Cell	$1.88	1.55 v.	1.50 v.	1.42 v.	95%	1.45 v.	97%
Ray-O-Vac	814-2	1.99	1.55	1.50	1.42	95	1.45	97
Sears	Die Hard 4683	2.39	1.55	1.50	1.42	95	1.44	96
Radio Shack	Alkaline 23-551	2.19	1.58	1.52	1.42	93	1.46	96
Panasonic	AM2	1.25 (1)	1.51	1.48	1.40	95	1.43	97
Eveready	Energizer E93	2.49	1.53	1.50	1.40	93	1.42	95
Duracell	MN1400	2.49	1.52	1.48	1.38	93	1.41	95
C-Cell Heavy Duty								
Radio Shack	Extra Life	1.10	1.60	1.57	1.43	91	1.49	95
Mallory	M14HD	.99	1.61	1.52	1.39	91	1.43	94
Ray-O-Vac	Heavy Duty 4C	.89	1.59	1.51	1.38	91	1.42	94
Eveready	1235	1.49	1.60	1.52	1.37	90	1.41	93
C-Cell General Purpose								
Eveready	935	.79	1.58	1.49	1.28	86	1.37	92
Sears	4671 (A BEST BUY)	.54	1.59	1.49	1.25	84	1.38	93
Radio Shack	23-467	.68	1.55	1.46	1.28	87	1.34	92
Treasury	Long Life	.77	1.57	1.45	1.22	84	1.34	92
C-Cell Rechargeable								
Gould	Again & Again (A BEST BUY)	(2)	1.40	1.39	1.28	92	1.28	92

(1) Sale Price
(2) Cost for battery charger and four C-cells, $19.95.

Table 1. Battery voltage measurements before and after one hour of use. Batteries are listed in order of overall use and recovery characteristics, although differences within groups are slight. See article text for discussion and buying recommendations.

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CIRCLE 223 ON READER SERVICE CARD

Batteries, continued...

	Average Price	Cost Per Hour
Alkaline	$2.10	$0.0512
Heavy Duty	1.12	.0509
General Purpose	0.70	.0389
Rechargeable	0.30	.0250

Table 2. Cost per hour of use of two C-cells in an electronic game drawing 100 ma.

nearly three years. However, our experience with rechargeable electric razors indicates that there is noticeable deterioration in performance after about 18 months (about 500 charges). This suggests that the theoretical maximum number of recharges may indeed be 1000, but that 500 may be a more realistic working boundary.

The cost of a charger is about $8-12 while two cells cost $6-9. This means the cost per use plus electricity for operating the charger based on 500 charges is less than 6 cents. Even with only 100 recharges, the cost is under 30 cents per use.

Counterbalancing this cost advantage is the much shorter use cycle. What this means in reality is that one must *remember* to put the batteries back on charge and that it is probably worthwhile to have two sets of batteries to exchange with each other.

Another problem is that for best life, the batteries should not be run down all the way before recharging, nor should they be recharged too soon. Each time into the charger for the required 14-16 hours counts as a recharge cycle. So if one recharges after only 15 or 30 minutes of use, that's still one recharge cycle used up. On the other hand, if one can expect ovr 500 recharges, then $12 to $18 for two new sets of batteries every two or three years is not at all unreasonable.

Battery Eliminators?

At $5 or $6 for the typical battery eliminator, its cost can frequently be justified on the very first set of batteries for an electronic game—rarely would it take more than three sets. Some Selchow & Righter games include discount coupons for an eliminator making it an irresistible deal. On the other hand, the obvious disadvantage of an eliminator is that the device is no longer portable. Eliminators just don't work on school buses or at the beach.

We were curious about the purity of the DC voltage from eliminators. Displaying the output on an oscilloscope revealed nasty sawtooth waves from all three eliminators. Fortunately the games we tested weren't at all fussy about well-filtered DC. However, we would strongly advise against using a cheap eliminator with any microproccessor-based circuit such as an Atari video computer system. Although it looks like an eliminator, the Atari power supply has a whopping condenser inside that smooths the output voltage considerably.

One problem we experienced with a so-called universal eliminator is that the four-way plug/outlet had no shanks on the plugs and thus would not work with games that had recessed jacks. More annoying was the fact that about half of the games we tested had no provision for an eliminator.

Battery Testers

Most inexpensive battery testers ($4-$10) are nothing more than voltmeters with, generally, five to seven different ranges to accomodate batteries of different voltage. The scale is typicaly marked with just two zones: replace (red) and good (green). On the 1.5v range on the Radio shack tester we bought, the division between the two ranges fell at 1.1v.

Since we found that most devices started to malfunction when voltage fell to 1.1, a tester is an accurate indicator of whether or not a battery will work, right?

Well, maybe. The Radio Shack tester, like most others, has three built-in loads for each voltage range. For 1.5v cells, the loads were 10 ma (150 ohms), 50 ma (30 ohms) and 150ma (10 ohms). The instructions recommend using the heavy load with D-cells, medium load with C-cells and light load with AA batteries. However, our measurements showed that some electronic games using AA batteries draw up to 200 ma. Thus a battery might read "good" on the low range (10 ma load) but would not operate in a game with a 200 ma current drain.

Alkaline	Heavy Duty	General Purpose
$2.75	$1.47	$1.21
2.50	1.34	1.10
2.25	1.21	.99
2.00	1.07	.88
1.75	.94	.77
1.50	.80	.66
1.25	.67	.55
1.00	.54	.44

Table 3. Equivalent prices of three types of batteries.

In general, we recommend using the medium and high load of a tester for all batteries. There are few devices, even including calculators, that draw as little as 10 ma. Even so, a tester will give only a general indication of condition.

The real test is whether or not the battery will power a particular game, radio or flashlight. And the only way to determine that is to try it in the device.

Conclusions

In tests approximating the use of batteries in electronic games alkaline batteries lasted for 41 hours, heavy duty batteries for 22 hours and standard carbon/zinc cells for 18 hours. Our tests in no way substantiated manufacturer claims for heavy duty batteries (more than twice the life) or alkaline batteries (up to seven times the life) compared to general purpose cells.

Assuming the prices we paid were representative, the cost to operate an electronic game requiring two C-cells would be about five cents per hour using either alkaline or heavy duty cells, just under four cents per hour using standard cells and two and one-half cents with recharageable batteries.

One of the "laws" of electronic game use is that the game will be left on overnight at least once a month. No matter what kind of cells are being used this will run them down. Hence, because of this as well as the comparative cost we recommend rechargeable batteries as the best buy. Our second choice would be to use a battery eliminator when the game is used at home and general purpose cells for other use. We recommend shopping for the cheapest general purpose cells and buying four or five sets. Manufacturer claims to the contrary, we can find little reason to pay premium prices for either heavy duty or alkaline batteries.

For use in cassette recorders or devices sure to be shut off after every use, alkaline batteries may represent a convenient (fewer battery changes) and economical alternative. But use Table 3 as a price guide. If a pair of standard cells cots $0.79, a pair of alkaline cells would have to cost $1.75 or less to be a better buy. Table 3, incidentally, is applicable to any kind of battery: D, C, AA or 9-volt.

Finally, a word of warning. We purchased one set of Treasury "Long Life" batteries which seemed to be heavy duty cells. It turned out they were simply general purpose cells. *Caveat emptor.* ☐

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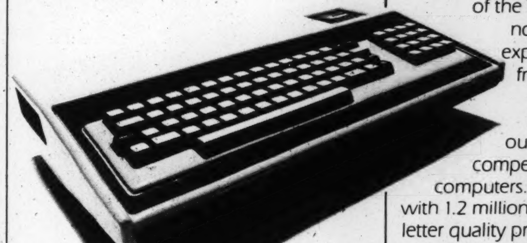

It was clearly ahead of its time and the competition in price and performance. The graphics were superior, upper/lower case characters were standard and numeric keyboard was included. Printer, communication and dual cassette electronics were built-in, not options. Twice as much information was displayed on the screen. **The competition created their next generation to catch up.**

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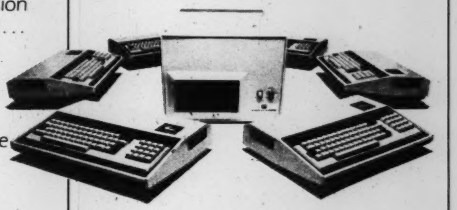

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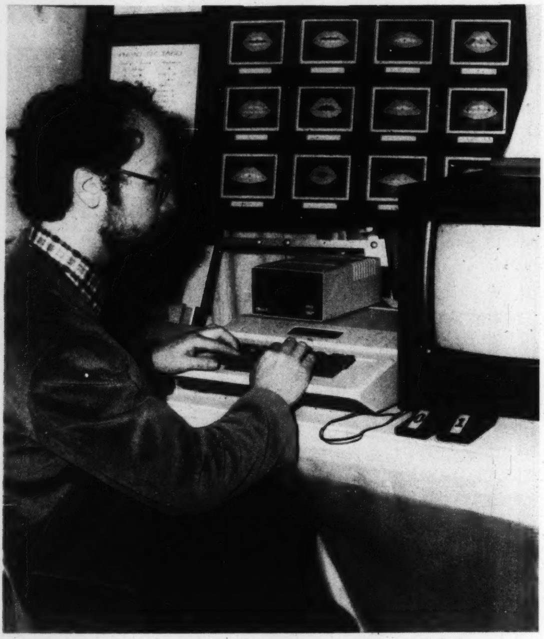
CIRCLE 177 ON READER SERVICE CARD

Personal Computers Help the Handicapped

Many people talk about the potential of personal computers to aid the handicapped. The entrants in The First National Search for Applications to Aid the Handicapped are among the first to begin tapping that potential.



Robin L. Hight types in sentences which are converted into animated lip movements and displayed on television screen as means of teaching lip reading.

Dr. Harry Levitt with TRS-80 Pocket Computer he has programmed to permit rapid communication by the deaf over public telephone lines.

A hearing and speech professor at the City University of New York, Dr. Harry Levitt, who programmed a TRS-80 Pocket Computer for rapid communication by the deaf over public telephone lines, was awarded the first prize of $10,000 in The Johns Hopkins University First National Search for Applications of Personal Computing to Aid the Handicapped.

Dr. Levitt who lives in Livingston, NJ, was presented the top prize of the year-long search and contest at the awards dinner at the Mayflower Hotel in Washington, D.C. Second prize of $3000 went to Dr. Mark Friedman, a professor and research engineer at Carnegie-Mellon University in Pittsburgh, PA and to colleagues Mark Dzmura, Gary Kiliany and Drew Anderson who developed an Eye-Tracker for Communication by severely disabled persons. The system allows a person to cause a word or phrase to become audible by looking at it on a computer screen.

The third prize award of $1,500 went to Robin L. Hight of St. Louis, MO, who developed a Lip-Reader Trainer. It aids in teaching of lip reading by converting typed sentences into displayed animated mouth movements.

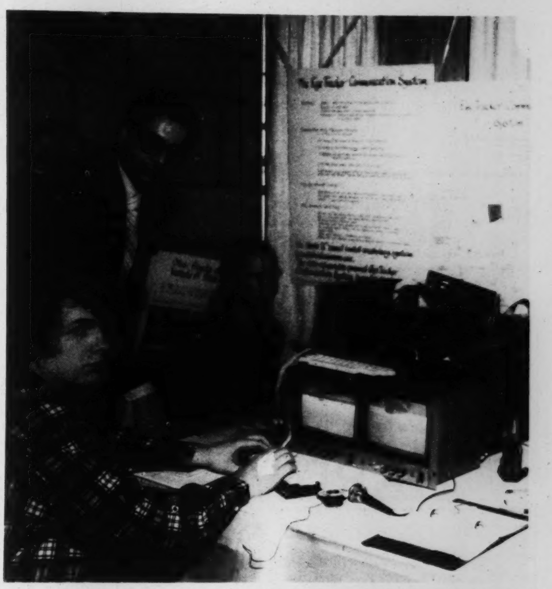
Seven other inventors received honorable mention awards of $500 each. All had been first place winners in regional competitions held during August. The search was sponsored by the National Science Foundation and Radio Shack, a division of the Tandy Corporation.

Dr. Levitt's prize winning entry, which he calls a Portable Telecommunicator for the Deaf, can be connected to a private or public telephone for instant communication between the deaf or those with normal hearing. Messages stored in the pocket computer memory can be transmitted instantly or the user can send a message via the keyboard. A line printer can be linked to the pocket computer, and messages can also be sent from a standard audio cassette.

"Perhaps the most important advantage of all is that the use of a pocket computer as a convenient, inexpensive communication device introduces the deaf telecommunicator user to the concept of an intelligent, computer-based communications system of almost unlimited scope and flexibility."

Dr. Levitt says that beside the advantages of compactness, memory, economy of

Dr. David L. Jaffe, with "smart wheelchair" designed to give even quadriplegics independent control. Ultrasonic range finders on the edges of the lapboard can determine the movement of the operator's head which can be used to control the movement and speed of the chair.



Dr. Mark Friedman, standing, with "Eye Tracker Communication System."

telephone time and cost, the system should reduce communication barriers between the deaf and hearing users.

Dr. Friedman's Apple-based eye tracking system allows severely handicapped nonvocal persons to express words and sentences up to four words long audibly by viewing them on a screen. It was developed to allow a severely handicapped grade-school girl, who has never had a voice, to "speak" in tones compatible with her age and sex. The sequence is triggered by an infrared camera which associates the look in the girl's eyes with the word she wants to vocalize.

Robin Hight, who works for Surface Systems, Inc., in St. Louis, describes his Lip-Reader Trainer (for the hearing impaired) as an aid to teaching. It instantly converts typed sentences into animated mouth movements or high-resolution graphic images which are displayed on a screen for use by teacher or student. His program also includes teaching sequences which provide choices and corrections for the student. The system, says Hight, does not replace face-to-face lip reading practice, but he feels it will augment the teaching of a skill which can enlarge the communication scope of the hearing impaired.

An honorable mention award was presented to Dr. Joseph T. Cohn, of Chapel Hill, NC, for his Augmentative Communication Device which turns a personal computer into a comprehensive control and communications prosthesis for the most profoundly handicapped.

Randy W. Dipner of Colorado Springs, CO, received honorable mention for a Micro-Braille System which allows production of low-volume, low-cost Braille text using off-the-shelf microprocessor hardware with minor modifications.

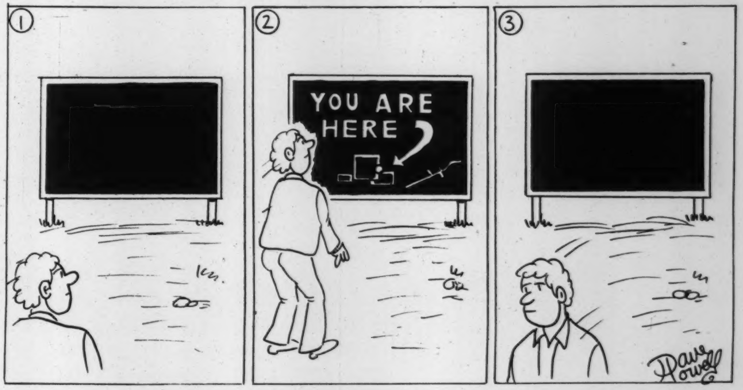
Sandra J. Jackson of San Antonio, TX, also received a $500 award for Programs for the Learning Disabled, which is a computer-based system designed to aid students with varying degrees of learning disabilities.

David L. Jaffe of Mt. View, CA received an award for an Ultrasonic Head Control for a Wheelchair. The system, employing ultrasound distance ranging technology, allows a quadriplegic in a wheelchair independent mobility.

Raymond Kurzweil of Newton Highlands, MA, received an honorable mention for a Reading Machine for the Blind. It converts ordinary printed or typed materials in any size, style or format or print into unlimited vocabulary, full-word synthetic English speech at speeds up to 1 1/2 times normal speech.

Paul F. Schwejda of Seattle, WA received an honorable mention for a Firmware Card Training Disk, which turns a computer into a mechanical pencil and paper for the severely physically handicapped.

The final honorable mention went to Robert E. Stepp, III, of Champaign, IL for a Braille Word Processor, an inexpensive, but full-powered Braille word processing system for use by transcribers of both text and non-text, including documents and musical scores. ☐



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CIRCLE 141 ON READER SERVICE CARD

Working at Home: Can Computers Help?

The following letter deals with the problem handicapped people have finding appropriate employment. We know our readers are creative and responsive, and we urge those of you who have thoughts on the subject to correspond with Mr. Willoughby.—EBS

Dear Editor:

Some of my handicapped friends and I wonder if your readers can help us with a problem. The problem starts out simple and then becomes complicated with frustrating barriers.

We have found that most handicap situations result in a mobility problem which effectively leaves the person home-bound—or vehicle-bound if he is luckier.

The home computer with appropriate telephone modem accessories seems to offer a tool with which the mobility problem can be overcome. This tool could open up new horizons for about 10 million disabled persons and, if effective, could reach another 30 million senior citizens and 30 million housewives.

This tool enables the handicapped person to do banking and shopping by telephone from the home. The deaf person might use the CRT presentation of the computer and flashing light warning accessories more than the average person. The blind person might go to a printer equipped with a Braille printhead.

The tool would enable more communication among handicapped people as well as giving them access to electronic newspapers, electronic mail, and databases with library and game categories. The problems with this solution become numerous at this point.

The average handicapped person is in some kind of a minimum pension situation which barely meets the expenses of just surviving. Often the spouse of such a person has to work to meet those expenses. The irony of the problem is that it does not matter how highly trained the handicapped person is. This training can be obtained through any Vocational Rehabilitation Office. If the handicapped person is home-bound, the training is mostly wasted when it comes to bringing home a salary. The reasons for this are extremely subtle.

I have approached about 500 companies nationwide from IBM, ITT, and GTE to Boeing Computer Services. Their employment sections treat me as a disabled person seeking employment at their local plant.

Most seem to do a mechanical matchup with available openings against resume descriptors. From these results a skeptic might wonder if the whole process could not be done more efficiently by a computer.

Even writing to company executives reveals that management and data processing systems can *not* handle a non-company person working at home in a service-type of function. Most people who do this are employees or former employees of the companies concerned.

The problem becomes still more frustrating when a handicapped person uses the normal employment agencies (state, federal and local). There are endless delays in responses with only about 30% of the companies even bothering to acknowledge receipt of your resume (with a form letter or postcard, of course).

From the company point of view, perhaps there is no opening of the nature desired. This conclusion leads to interesting speculation about who is buying all the modems and microcomputers, as well as the purpose for which they are being used.

The problem then becomes what kind of function and ability can companies purchase off-site (from home-bound handicapped persons). To suggest to companies the possible areas in which this can be done, I have drawn a list of areas in which I have partial or complete software for immediate use or can get it reasonably quickly. See Figure 1.

Figure 1.

1. Mailing lists (3000 names/diskette)
2. Bookkeeping
3. Payroll and benefits
4. Inventory management
5. Accounting, billing
6. Stock market management
7. Data analysis
8. Data processing
9. Statistical analysis
10. Curve fitting
11. Modeling
12. Life-cycle cost analysis
13. Vehicle/system simulation
14. Costing/pricing
15. Decision making
16. Checks/statement balancing
17. Building cost analysis
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CIRCLE 152 ON READER SERVICE CARD

Figure 1, continued

25. Population projections
26. Department profitability and comparisons
27. Biorhythms
28. Couple conflict areas
29. Database searches ($300/connect hr. plus $0.50/record offline print)
30. Computer systems networking
31. Engineering calculations
32. Operations Research and Analysis
33. Distributed Information Networks
34. Electronic medical diagnostics and pharmaceutical information
35. Electronic Paralegal researching

These are just a few of the areas in which a handicapped person in a home bound situation can use a home computer to support client companies.

The handicapped person is often either totally ignorant of the marketplace or unable to use it effectively. In the future, disabled people need to know how much computer power is needed and what training is needed to become a successful home-business person.

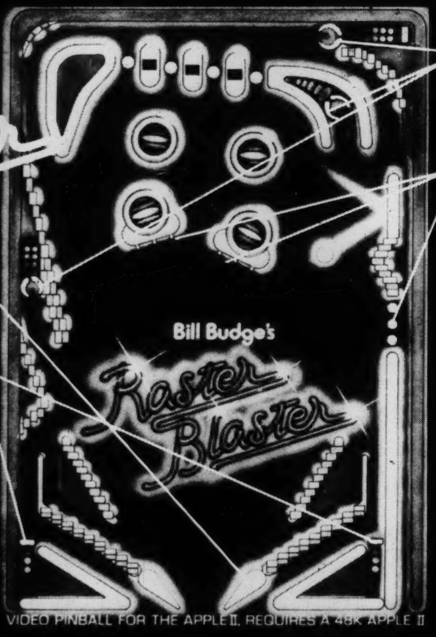
The above analysis is more or less oriented around my background which includes twenty years of engineering and computer experience. I have the 64K Radio Shack TRS-80 Model II with the Lineprinter II and telephone modem. Any home-bound handicapped person's situation will fit somewhere within the boundaries of the above analysis. My handicapped friends have been using me as a guinea pig to find the conduit of which I spoke before. Several social workers and counselors are also interested.

The only thing that I have found which approximates that conduit is Writer's Market, 9933 Alliance Rd., Cincinnati, OH 45242. Unfortunately it only caters to writers.

Can your readers suggest other places where the home-bound person can tap into the market? I almost forgot to mention that there are numerous cost and tax savings associated with using a handicapped person in a work situation. A tax lawyer would have to describe all the details, but I have been told that 50% or more of the cost to a client could be written off.

Kenneth Willoughby
Box 317
Fairacres, NM 88033

Probably the primary obstacle facing a person who wants to work at home is obtaining the necessary training to understand the goals, needs, priorities, policies, procedures, and work specifications of the hiring company. The problem is that it is much more difficult to train people without the immediate feedback and correction possible in person. Telephone, mail, or even on-line terminal communications are simply not as effective. This communication problem also affects supervision. It takes longer and is therefore more expensive to verify the quality of an employee's work without personal contact. However, once confidence is established, and it is known that the employee needs little supervision, remote labor is much simpler. Most people who currently work at home have previously worked in person at their present company for these reasons.—GB


Bill Budge's
Raster Blaster
VIDEO PINBALL FOR THE APPLE II, REQUIRES A 48K APPLE II

Bill Budge's
Raster Blaster

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Raster Blaster for the Apple II and the Apple II Plus may be the first Apple II game that is copied for the arcade machines. It is so technically sophisticated and fun to play that it is sure to attract the big arcade manufacturers. But you can get it right now for your Apple!

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Requires a 48K Apple II

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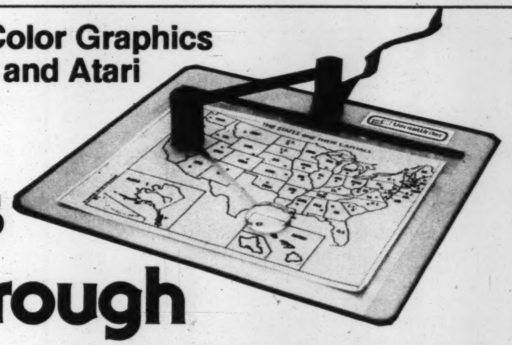
CIRCLE 151 ON READER SERVICE CARD

© BudgeCo 1981

High-Resolution Color Graphics for the Apple and Atari



Graphics Breakthrough

How many programs have you written that would benefit from animated high-resolution graphics? Probably several. It is this kind of dramatic graphics that distinguish outstanding programs from ordinary ones. But if you've ever agonized for hours or days just to get one image perfected, you're probably not anxious to do it again. Now there's a better way.

New Graphics Entry System

Today there is a new graphics system available that is not only amazingly user-oriented but surprisingly economical. Called VersaWriter, it starts with an ingeniously simple entry board consisting of a 14" X 12" high impact plastic bed with a tough clear plastic overlay sheet. The original drawing or diagram is fastened with masking tape to the plastic bed and then covered with the clear sheet. Instead of using a light pen or complicated electronic X-Y head, the VersaWriter uses a double jointed arm attached to the top of the entry board at one end and a magnifying lens with crosshairs at the other end. The VersaWriter resembles a draftsman's pantograph on a smaller scale.

At each joint in the arm of the VersaWriter is a potentiometer. A cable from these pontentiometers connects to the paddle input of the computer. No special interface electronics or board is needed. Since the arm of the VersaWriter bends only in one direction, each point on the plotting head corresponds to a unique set of resistances on the potentiometers. All that's needed now is software to translate these resistances into usable screen coordinates.

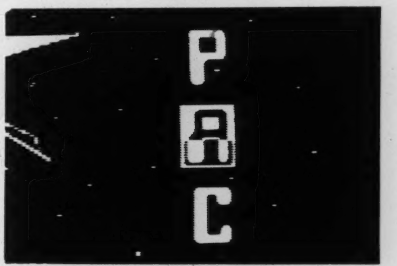
Exceptionally powerful software

It is in the software where VersaWriter really stands out. VersaWriter comes with two full disks of user-oriented software. First it has sets of "low level" commands for entering, creating and copying drawings and diagrams. Secondly, it has extensive sets of application routines for moving, enlarging, rotating, coloring or animating drawings that the user has created.

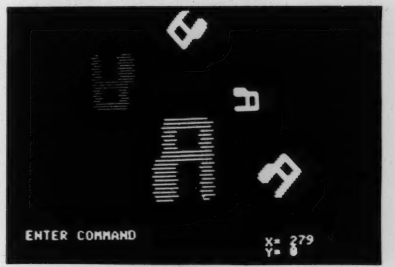
Graphics Systems

Versa Writer	**$249.00**
Kurta Graphics Tablet	**695.00**
Summagraphics Digitizer	**745.00**
Houston Instruments Hi Pad	**795.00**
Apple Graphics Tablet	**795.00**

Of course the basic commands let you enter a drawing freehand or by tracing it. Want a wider brush stroke? Six widths are available. Drawings can be independently scaled in both the vertical and horizontal directions. An enclosed shape may be filled in with any of 106 colors. No, that is not a misprint—By the same technique that a printing press can create hundreds of colors from the three primary ones, so can VersaWriter.



Here a shape (the letter A) is being scanned. After putting it in a shape table it may be used in other programs.



ENTER COMMAND

X= 279
Y= 0

From the shape table, a shape (the letter A) may be enlarged, rotated, colored or moved about the screen.

Create Animation for Other Programs

The shapes you create with VersaWriter can be used and manipulated with ease in other programs. Up to 255 shapes can be entered into a shape table. These shapes may then be placed on the screen in any position or may be overlaid on a full or partial screen image. Animation is produced easily by moving about a portion of the image created by VersaWriter. For example, by alternating between two images of an airplane propeller it will appear to be spinning.

Other VersaWriter software includes text-writer with which text can be added to graphics. Upper and lower case, choice of color, text size, direction and starting point all may be specified.

The Area/Distance program lets you calculate distances (or perimeters) by entering a scale and tracing a shape or map route with the drawing arm. Areas of figures, open and irregular, can be similarly calculated.

The software also includes sets of electronic and computer logic shapes. In addition, an entire disk of dramatic demonstration graphics is included. These twelve full-screen graphics run the gamut from a fully labeled cross section of a human skull to colored maps to animated cartoons to an electronics schematic.

Software Updates

You may have read a review of VersaWriter that indicated that the color fill routine was slow. It was. But not any more. Several routines and improvements were added to the VersaWriter software since its introduction. An added feature, the Expansion Pac, is also now available. This third disk of software contains an area distance program, a microscope feature, and will save your graphics in the exact colors you prefer. It also includes shape tables for architecture, plumbing, electrical, circuit boards, landscape, chemistry, games, and more; 350 predefined shapes in all.

At Peripherals Plus, we evaluated every graphics device. We wanted to handle the best one regardless of price. VersaWriter has the best performance bar none. Surprisingly, it also has the lowest price, just $299.00 for the Apple version. It requires an Apple II Applesoft in Rom (or an Apple II Plus), disk, and 48K memory. VersaWriter comes complete with two disks of software, a comprehensive instruction manual, and a 90-day limited warranty. The additional Expansion Pac is available for $39.95.

The Atari version, which varies slightly from the Apple version in number and types of functions performed, is available for $299.00. As new updates are developed for the Atari, Peripherals Plus will furnish them free to all customers—just send us the disk and we'll supply the updated material. We make this unique offer because it is in our best interest to have you make the best use of your computer. We're also convinced that if other people see your VersaWriter in use they'll want one too.

Try VersaWriter for 30 days. If you are not completely satisfied we'll give you a prompt and courteous refund of the full price plus shipping both ways.

To order, specify Apple or Atari version, send payment plus $3.00 shipping and handling to Peripherals Plus, 39 East Hanover Ave., Morris Plains, NJ 07950. (New Jersey residents please add 5% Sales tax.) Credit card customers should include card number and expiration date of Visa, MasterCard or American Express card. Credit card customers may also call toll-free 800-631-8112 (in NJ 201-540-0445).

For spectacular graphics on your computer, order VersaWriter today.

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CIRCLE 239 ON READER SERVICE CARD

The Talking Wheelchair

A Computer Age Prosthesis for People with Communications Handicaps

Barbara Deane

For the estimated 1 1/2 million people in the U.S. who are unable to speak intelligibly, computer science at present can offer only the old "good news/bad news" bromide. The good news is that, yes, there is a "talking wheelchair" that can communicate for them. But the bad news is that it is not yet on the market, nor will it be until a manufacturer is found.

The existing model was put together at Children's Hospital, Stanford University, through the efforts of Maurice LeBlanc, head of its Rehabilitation Engineering Department, and Psycho-Linguistic Research Associates, a consulting firm in Menlo Park, CA, that specializes in human/computer interactions and Charles Lingel, Engineering Consultant. The project was funded by a grant from NASA's Ames Research Center in Mountain View, CA, and coordinated by the Stanford University Biomedical Applications Team, a program established by NASA in 1966 to apply aerospace technology to the solution of biomedical problems.

The talking wheelchair, the formal name for which is Versatile Portable Speech Prosthesis or VPSP, adapts existing hardware which is mounted on a wheelchair and runs off a standard 24-volt wheelchair battery. Software was developed by Carol A. Simpson of Psycho-Linguistics, a Ph.D. in linguistics and Douglas H. Williams, a Ph.D. in psychology, who drew on their experience in developing synthesized voice systems for NASA.

Carol Simpson, Ph.D. of Psycho-Linguistics Research Associates, developers of software for the "Talking Wheelchair" demonstrates the VPSP.

If the VPSP has the appearance of a car that has been put together from spare parts, that's because it has: a typewriter keyboard here, an old TV set there, a button from who-knows where. The inventors augmented their grant funds by using equipment donated by manufacturers and by scrounging. The result is cumbersome, but it works.

Mounted behind the wheelchair in a metal box is an S-100 bus Z-80 computer with 16K RAM, mini-floppy disk drive and a special interface board for the CRT and synthesizer. Directly below that is a Votrax Model ML-1 phoneme speech synthesizer.

The speaker is in a blue wooden box on the side of the chair. The power supply, consisting of DC-DC converters to change the 24-volt wheelchair power to regulated voltages required for the computer and synthesizer, is located underneath the chair. Visual display is provided by a modified 5" TV set, mounted in front on the right side of the wheelchair on a metal shelf, facing the user.

Controlling the System

To control the system, the user has three choices, depending on his physical capabilities. The easiest and fastest is the keyboard (a modified standard typewriter keyboard plugged into the computer) which can be operated by either finger-touch or a headstick. Software for the keyboard user provides a total of 78 pages. Four of these are for instructions, etc., leaving 74 blank pages of 512 characters each for the user to fill in.

The VPSP has the appearance of a car that has been put together from spare parts.

After pushing the red "on" button and waiting for a 30-second warmup, the user sees the menu, and a table of contents is displayed in rows of four-letter codes. He types the code he has selected, presses the "go" key and the page appears on the screen. If he is using a previously prepared message which is on this page, he selects it, presses the "talk" button and the message is recited in the Votrax's understandable, but-slightly-Swedish accent.

To compose messages, the user types them out on the keyboard and they appear

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Barbara Deane, 1675 Kasba St., Concord, CA 94518.

on the screen. From here, the system works like a word processor and the user can edit his text until he is satisfied with it. Unless he deliberately erases it, all messages are automatically stored in the memory for future use, a feature that all the handicapped testers of the VPSP particularly liked.

Additional software had to be designed for the non-keyboard user, including a quite different page structure. For those unable to use a keyboard, picking out each message individually letter-by-letter would take too long and be too tiring. So the joystick and single-switch versions of the system provide a dictionary of 925 most-used words in English, an "ask a question" page, a "make a phrase" page, a page of connector words, etc. For spelling out words not in the system, there is a page of letters laid out in columns in the order in which they appear in English syllables.

When the system is activated, a page structure, consisting of four columns of words and a fifth column of instructions to the computer, appears on the screen. A cursor is provided to give directional instructions.

Those who have the physical ability to use a joystick move the cursor to the letter or word they want, then push the "select" button to tell the computer to execute the command. The letter or word they select appears in the message space, and from then on, the editing, storing and talking capabilities of the system are the same as described for keyboard use.

If the user can't manage a joystick but has some physical movement, he can use a five-slot switch invented at Children's Hospital and drive the cursor by placing a hand, elbow or even a foot in one of the four slots corresponding to the four directions in which the cursor moves. A fifth slot is the "select" instruction to the computer.

But those who are too severely handicapped even for that can still use the VPSP. In the single-switch mode, the computer moves the cursor and all the user has to do is to press a button to stop the scan where he wants it. He presses it once more and the computer executes the command.

To use the single switch, the first thing the handicapped person must do is select from a list of eight scanning speeds the speed most comfortable for him to use. This gave Drs. Simpson and Williams one of their many time-consuming problems in programming.

"The simplest thing would have been to tell the computer to double each previous speed," Dr. Simpson said. "But when we did that, we wound up with a first speed so slow that nobody could stand it and an eighth speed that no human being could possibly keep up with."

For a system designed to make communication as easy as possible for a handicapped user, this obviously wouldn't do.

To compose messages, the user types them out on the keyboard and they appear on the screen.

"It took much more memory and code to come up with eight usable speeds," Dr. Williams said. "This was an example of user orientation. We did this project like aerospace designs which involve the pilots who will actually be using the system and get their input every step of the way."

Since many users of the single switch mode will be cerebral palsy victims who often make spastic movements and might hit the switch unintentionally, Simpson and Williams provided a "verify" device. In the "verify" mode, the cursor flashes for a few seconds after the user stops it. If he has made an error, he can cancel by hitting the switch while the light is still flashing. If he doesn't hit the switch, the light stops flashing and he can go on.

"In other words," Williams said, "if you like what you have, you do nothing. This makes it as easy as possible for the user. Also, we found that some people developed better muscular control after they had used the system for a while and they didn't need "verify" any more."

The origins of the VPSP go back to a suggestion made to Dr. Simpson in 1975 by Dr. Kenneth Colby, director of the Speech Prosthesis Project, Neuropsychiatric Institute, UCLA, and to the ideas of John Eulenberg, director of the Artificial Language Laboratory, Department of Computer Science, Michigan State University.

Software Design

In the software design, Charles Lingel divided the 5 1/4" storage disk into three parts. The first part is the same for all three modes of operation: keyboard, joystick and single switch. Both joystick and single-switch operation have different page layouts from the keyboard. Then, additional programming had to be provided to drive the cursor in the single-switch operation.

Votrax now has available text-to-speech rules in ROM, but at the time this project began in 1978, this software was not available. Dr. Simpson was able to borrow and adapt rule-interpreter software by Dan Christinaz, programmer at UCLA, making it possible to develop the program which tells the computer how to pronounce what the user writes.

The most time-consuming part of the software design was working out page layouts that would make it as easy as possible for users to locate what they wanted. These took nine months to rough out and another three months to refine.

During this time, Dr. Simpson conducted experiments on visual search times using six different page layouts. She tried com-

At a conference table at Children's Hospital, Stanford University, are left to right Dr. Simpson and Douglas Williams, Ph.D. in Psycho-Linguistics and Maurice A. LeBlanc, chief of the Rehabilitation Engineering Department at Children's Hospital. On the table is the five-slot switch, invented at Children's Hospital, which enables the handicapped person who can't use a joystick to work a switch by placing a hand, elbow or foot in one of the slots.

DYNACOMP

Quality software for:*

ATARI
PET
APPLE II Plus
TRS-80 (Level II)**
NORTH STAR
CP/M Disks/Diskettes
(see Availability box)

CARD GAMES

BACCARAT (Atari only) **Price: $18.95 Cassette/$22.95 Diskette**
This is the European card game which is the favorite of the Monte Carlo jet set. Imagine yourself at the gaming table with 007 to your left and Goldfinger to your right. Learn and play BACCARAT at your leisure on the Atari. Contains full high resolution color graphics and matching sound. Runs in 16K. Requires one joystick.

GIN RUMMY (Apple only) **Price: $18.95 Cassette/$22.95 Diskette**
This is the best micro computer implementation of GIN RUMMY existing. The computer plays exceptionally well, and the HIRES graphics are superb. What else can be said?

POKER PARTY (Available for all computers) **Price: $17.95 Cassette/$21.95 Diskette**
POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of these players (you will get to know them) has a different personality in the form of a varying propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple cassette and diskette versions require a 32 K (or larger) Apple II.

CRIBBAGE 2.0 (TRS-80 only) **Price: $14.95 Cassette/$18.95 Diskette**
This is simply the best cribbage game available. It is an excellent program for the cribbage player in search of a worthy opponent as well as for the novice wishing to improve his game. The graphics are superb and assembly language routines provide rapid execution. See the software review in 80 Software Critique.

THOUGHT PROVOKERS

MANAGEMENT SIMULATOR (Atari, North Star and CP/M only) **Price: $19.95 Cassette/$23.95 Diskette**
This program is both an excellent teaching tool as well as a stimulating intellectual game. Based upon similar games played at graduate business schools, each player or team controls a company which manufacturers three products. Each player attempts to outperform his competitors by setting selling prices, production volumes, marketing and design expenditures etc. The most successful firm is the one with the highest stock price when the simulation ends.

FLIGHT SIMULATOR (Available for all computers) **Price: $17.95 Cassette/$21.95 Diskette**
A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS. Runs in 16K Atari.

VALDEZ (Available for all computers) **Price: $15.95 Cassette/$19.95 Diskette**
VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 × 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modelled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software reviews in 80 Software Critique and Personal Computing.

BACKGAMMON 2.0 (Atari, North Star and CP/M only) **Price: $14.95 Cassette/$18.95 Diskette**
This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play against itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.

CHECKERS 3.0 (PET only) **Price: $16.95 Cassette/$20.95 Diskette**
This is one of the most challenging checkers programs available. It has 10 levels of play and allows the user to change skill levels at any time. Although providing a very tough game at level 4-8, CHECKERS 3.0 is practically unbeatable at levels 9 and 10.

CHESS MASTER (North Star and TRS-80 only) **Price: $19.95 Cassette/$23.95 Diskette**
This complete and very powerful program provides five levels of play. It includes castling, en passant captures and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the program is written in assembly language (by SOFTWARE SPECIALISTS of California). Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users. See review in onComputing.

LEM LANDER (32K Apple Disk only) **Price: $16.95 Diskette**
Pilot your LEM LANDER to a safe landing on any of nine different surfaces ranging from smooth to treacherous. The game paddles are used to control craft attitude and thrust. This is a real-time high res challenge!

FOREST FIRE! (Atari only) **Price: $16.95 Cassette/$20.95 Diskette**
Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalties. Life-like variables are provided to make FOREST FIRE! very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty.

SPACE EVACUATION! (Apple, Atari and TRS-80 only) **Price: $15.95 Cassette/$19.95 Diskette**
Can you colonize the galaxy and evacuate the Earth before the sun explodes? Your computer becomes the ship's computer as you explore the universe to relocate millions of people. This simulation is particularly interesting as it combines many of the exciting elements of classic space games with the mystery challenge of ADVENTURE.

MONARCH (Atari only) **Price: $11.95 Cassette/$15.95 Diskette**
MONARCH is a fascinating economic simulation requiring you to survive an 8-year term as your nation's leader. You determine the amount of acreage devoted to industrial and agricultural use, how much food to distribute to the populace and how much should be spent on pollution control. You will find that all decisions involve a compromise and that it is not easy to make everyone happy. Runs in 16K Atari.

CHOMPELO (Atari only) **Price: $11.95 Cassette/$15.95 Diskette**
CHOMPELO is really two challenging games in one. One is similar to NIM; you must bite off part of a cookie, but avoid taking the poisoned portion. The other game is the popular board game REVERSI. It fully uses the Atari's graphics capability, and is hard to beat. This package will run on a 16K system.

SPACE LANES (Available for all computers) **Price: $10.95 Cassette/$14.95 Diskette**
SPACE LANES is a simple but exciting space transportation game which involves up to four players (including the computer). The object is to form and expand space transportation companies in a competitive environment. The goal is to amass more net worth than your opponent. The economics include stock purchases and company mergers. Watch your wealth grow!

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II) and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard (IBM 3740 single density/double density compatible format) 8" CP/M floppy disks for systems running under MBASIC (for example, Altos, Xerox 820 and many others). 5¼" CP/M diskettes are available for the North Star and Osborne computer systems.

DYNACOMP OFFERS THE FOLLOWING

- Widest variety
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- Fastest delivery
- Friendly customer service
- Free catalog
- 24 hour order phone

AND MORE...

STARTREK 3.2 (Available for all computers) **Price: $11.95 Cassette/$15.95 Diskette**
This is the classic Startrek simulation, but with several new features. For example, the Klingons now shoot at the Enterprise without warning while also attacking starbases in other quadrants. The Klingons also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Enterprise is besieged by three heavy cruisers and a starbase S.O.S. is received! The Klingons get even! See the software reviews in A.N.A.L.O.G., 80 Software Critique and Game Merchandising.

BLACK HOLE (Apple only) **Price: $14.95 Cassette/$18.95 Diskette**
This is an exciting graphical simulation of the problems involved in closely observing a black hole with a space probe. The object is to enter and maintain, for a prescribed time, an orbit close to a small black hole. This is to be achieved without coming so near the anomaly that the tidal stress destroys the probe. Control of the craft is realistically simulated using side jets for rotation and main thrusters for acceleration. This program employs Hi-Res graphics and is educational as well as challenging.

SPACE TILT (Apple and Atari only) **Price: $10.95 Cassette/$14.95 Diskette**
Use the game paddles to tilt the plane of the TV screen to "roll" a ball into a hole in the screen. Sound simple? Not when the hole gets smaller and smaller! A built-in timer allows you to measure your skill against others in this habit-forming action game.

ESCAPE FROM VOLANTIUM (Atari only) **Price: $15.95 Cassette/$19.95 Diskette**
Bring the action and excitement of an arcade into your home with ESCAPE FROM VOLANTIUM! To escape you must maneuver your space ship around obstacles and laser blast the dragon (without being eaten). If he is killed with a direct shot (not just a leg lopped off), a door opens to the outside. However, the door does not stay open indefinitely. If you fail to escape in time, the door closes and a new dragon appears. Sometimes you can smash through the door by repeatedly chipping away at it. Other times it is impervious. At the higher levels of play more obstacles and dragons appear, adding to the excitement. Uses high resolution graphics and sound. Runs in 16K.

ALPHA FIGHTER (Atari only) **Price: $14.95 Cassette/$18.95 Diskette**
Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion; let five UFO's get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.

THE RINGS OF THE EMPIRE (Atari only) **Price: $16.95 Cassette/$20.95 Diskette**
The empire has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.

INTRUDER ALERT (Atari only) **Price: $16.95 Cassette/$20.95 Diskette**
This is a fast paced graphics game which places you in the middle of the "Dreadstar" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.

MIDWAY (Atari only) **Price: $14.95 Cassette/$18.95 Diskette**
MIDWAY is an exciting extension of the game of Battleship. It mixes the challenges of strategy and chance. Your opponent can be another human or the computer. Color graphics and sound are both included. Runs in 16K.

TRIPLE BLOCKADE (Atari only) **Price: $14.95 Cassette/$18.95 Diskette**
TRIPLE BLOCKADE is a two-to-three player graphics and sound action game. It is based on the classic video arcade game which millions have enjoyed. Using the Atari joysticks, the object is to direct your blockading line around the screen without running into your opponent(s). Although the concept is simple, the combined graphics and sound effect lead to "high anxiety".

GAMES PACK I (Available for all computers) **Price: $10.95 Cassette/$14.95 Diskette**
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSERACE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.

GAMES PACK II (Available for all computers) **Price: $10.95 Cassette/$14.95 Diskette**
GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.

Why pay $7.95 or more per program when you can buy a DYNACOMP collection for just $10.95?

MOON PROBE (Atari and North Star only) **Price: $11.95 Cassette/$15.95 Diskette**
This is an extremely challenging "lunar lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle. Runs in 16K Atari.

SPACE TRAP (Atari only, 16K) **Price: $14.95 Cassette/$18.95 Diskette**
This galactic "shoot'em up" arcade game places you near a black hole. You control your spacecraft using the joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.

CHIRP INVADERS (PET/CBM only) **Price: $14.95 Cassette/$18.95 Diskette**
CHIRP INVADERS is an addictive game using action graphics. A Federation space station must be reached before the Chirps conquer the Earth. Stationary obstacles, moving meteors, and the attacking Chirps must all be avoided for a successful journey. Good luck.

ADVENTURE

CRANSTON MANOR ADVENTURE (North Star and CP/M only) **Price: $29.95 Diskette**
At last! A comprehensive Adventure game for North Star and CP/M systems. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are wild animals and robots who will not give up the treasures without a fight. The number of rooms is greater and the associated descriptions are much more elaborate than the current popular series of Adventure programs, making this game the top in its class. Play can be stopped at any time and the status stored on diskette. Not available in 5¼" CP/M format.

GUMBALL RALLY ADVENTURE (North Star only, 48K) **Price: $21.95 Diskette**
Take part in this outlaw race from the east coast to the west coast. The goal is to find your way to the finish line while maintaining the highest possible speed. You may choose one of five cars available at the garage. The choice will affect your speed and range. Remember to take spare parts and don't get caught speeding!

UNCLE HARRY'S WILL (North Star only, 40K) **Price: $24.95 Diskette**
Uncle Harry has died and has left you everything. However, he has neglected to mention where everything is! Instead, his will consists of a poem which contains clues. You will have to travel all over the United States both by car and on foot to solve the puzzle, and there are over 300 locations to probe. Be careful and watch out for red herrings!

SPEECH SYNTHESIS

DYNACOMP is now distributing the new and revolutionary TYPE-'N-TALK™ (TNT) speech synthesizer from Votrax. Simply connect TNT to your computer's serial interface, enter text from the keyboard and hear the words spoken. TNT is the easiest-to-program speech synthesizer on the market. It uses the least amount of memory and provides the most flexible vocabulary available anywhere!

List price $375. DYNACOMP'S price $329.95. Please add $5.00 for shipping and handling.

TALK TO ME (T'N'T Atari only, 24K) **Price: $14.95 Cassette/$18.95 Diskette**
This program presents a superb tutorial on speech synthesis using the Atari 800 and TYPE 'N TALK™. TALK TO ME will illustrate normal word generation as well as phoneme generation. The documentation includes many helpful programming tips.

MISCELLANEOUS

CRYSTALS (Atari only) **Price: $ 9.95 Cassette/$13.95 Diskette**
A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari. Runs in 16K Atari.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY
DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.

Price: $9.95 each/$7.95 each (4 or more)
The complete collection may be purchased for $149.95

**ATARI, PET/CBM, NORTH STAR, CP/M, IBM, OSBORNE and XEROX are registered tradenames and/or trade marks.*

***Except where noted, all TRS-80 Model I software is available on cassette (only) for the TRS-80 Model III. Exceptions: VALDEZ, CRIBBAGE, GRAFIX, CHESSMASTER. TRS-80 diskettes are not supplied with either DOS or BASIC.*

BUSINESS and UTILITIES

MAILMASTER (Atari diskette only) — **Price: $39.95 Diskette**

MAILMASTER is a very versatile software package for managing and manipulating mail lists and mini data bases. Each disk can hold over 700 customer entries containing name, address, three 3-letter key words and a phone number. The display is marked so that entries may be made and edited with ease. The status (e.g., disk space left, options, etc.) is shown at all times. Labels may be printed 1,2 or 3 up, and all sorting (zip code and alphabetic) is performed by a fast machine language program.

SORTIT (North Star only) — **Price: $29.95 Diskette**

SORTIT is a general purpose sorting program written in 8080 assembly language. This program will sort sequential data files generated by NORTH STAR BASIC. Primary and optional secondary keys may be numeric or one to nine character strings. SORTIT is easily used with files generated by DYNACOMP's MAIL LIST program and is very versatile in its capabilities for all other BASIC data file sorting.

PERSONAL FINANCE SYSTEM (Atari and North Star only) — **Price: $39.95 Diskette**

PFS is a single diskette, menu-oriented system composed of ten different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payee, and display information on expenditures by any of 26 user defined codes by month or by payee. PFS will even produce monthly bar graphs of your expenses by category! This powerful package requires only one disk drive, minimal memory (24K Atari, 32K North Star) and will store up to 600 records per disk (and over 1000 records per disk by making a few simple changes to the programs). You can record checks plus cash expenses so that you can finally see where your money goes and eliminate guesswork and tedious hand calculations. Contains high speed machine language sort.

FAMILY BUDGET (Apple and Atari only) — **Price: $34.95 Diskette**

FAMILY BUDGET is a very convenient financial record-keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries to any of 21 different expense accounts as well as to 5 payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

INTELINK (Atari only) — **Price: $49.95 Diskette**

This software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex modem (required for use). In one mode of operation you may connect to a data service (e.g., The SOURCE or MicroNet) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a *very* smart terminal. Even Atari BASIC programs may be uploaded. Further, a command file may be built off-line and used later as controlling input for a time-share system. That is, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed; batch processing. All this adds up to saving both connect time and your time.

TEXT EDITOR II (CP/M) — **Price: $29.95 Diskette/$33.45 Disk**

This is the second release version of DYNACOMP's popular TEXT EDITOR I and contains many new features. With TEXT EDITOR II you may build text files in chunks and assemble them for later display. Blocks of text may be appended, inserted or deleted. Files may be saved on disk/diskette in right justified/centered format to be later printed by either TEXT EDITOR II or the CP/M ED facility. Futher, ASCII CP/M files (including BASIC and assembly language programs) may be read by the editor and processed. In fact, text files can be built using ED and later formatted using TEXT EDITOR II. All in all, TEXT EDITOR II is an inexpensive, easy to use, but very flexible editing system.

DFILE (Atari and North Star diskettes only) — **Price: $19.95**

This handy program allows North Star and Atari disk users to maintain a specialized data base of all files and programs in the stack of disks which invariably accumulates. DFILE is easy to set up and use. It will organize your disks to provide efficient locating of the desired file or program.

FINDIT (North Star only) — **Price: $19.95**

This is a three-in-one program which maintains information accessible by keywords of three types: Personal (eg: last name), Commercial (eg: plumbers) and Reference (eg: magazine articles, record albums, etc). In addition to keyword searches, there are birthday, anniversary and appointment searches for the personal records and appointment searches for the commercial records. Reference records are accessed by a single keyword or by cross-referencing two or three keywords.

SHOPPING LIST (Atari only) — **Price: $12.95 Cassette/$16.95 Diskette**

SHOPPING LIST stores information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with 16K.

TAX OPTIMIZER (North Star only) — **Price: $59.95 Diskette**

The TAX OPTIMIZER is an easy-to-use, menu oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is computed by all tax methods (regular, income averaging, maximum and alternate minimum tax). The user may immediately observe the tax effect of critical financial decisions. TAX OPTIMIZER has been thoroughly field tested in CPA offices and comes complete with the current tax tables in its data files. TAX OPTIMIZER is tax deductible!

UTIL (Apple only, 48K) — **Price: $19.95 Diskette**

UTIL is a disk-oriented utility system which permits examining and changing of the contents of DOS 3.2 and 3.3 diskettes at the bit (nibble or byte) level. With UTIL you can easily examine the contents of a diskette sector by sector, restructure the sector pointers, reallocate sectors (e.g. bad sectors may be "hidden"), and perform many other sophisticated operations. For the experienced programmer.

TURNKEY AND MENU (Atari only) — **Price: $17.95 Diskette**

TURNKEY is a utility program which allows you to create autoboot/autorun diskettes easily. Simply load and run TURNKEY, load the program diskette to be modified, and answer the questions! The TURNKEY diskette also comes with DOS 2.0 and includes another program, MENU. MENU lists the contents of your diskette alphabetically, and permits the running of any BASIC program on the diskette by typing a single key. TURNKEY and MENU provide you with the ability to run any program on your diskette by simply turning on the computer and pressing a single key.

STOCKAID (Atari only) — **Price: $29.95 Diskette**

STOCKAID provides a powerful set of tools for stock market analysis. With STOCKAID you can display point and figure charts, as well as bar charts with oscillators. You can also examine long term moving averages and on-balance volume features. STOCKAID allows you to input daily data with a single diskette storage capability of 239 days × 16 stocks. Included are stock dividend and split adjustment capabilities. A very professional package!

EDUCATION

HODGE PODGE (Apple only, 48K Applesoft or Integer BASIC) — **Price: $19.95 Cassette/$23.95 Diskette**

Let HODGE PODGE be your child's teacher. Pressing any key on your Apple will result in a different and intriguing "happening" related to the letter or number of the chosen key. The program's graphics, color and sound are a delight for children from ages 1½ to 7. HODGE PODGE is a non-intimidating teaching device which brings a new dimension to the use of computers in education. See review in Infoworld.

TEACHER'S AIDE (Atari only) — **Price: $13.95 Cassette/$17.95 Diskette**

TEACHER'S AIDE consists of three basic modules contained in one program. The first module provides addition and subtraction exercises of varying levels of difficulty. The second module consists of multiplication problems in which the student may be tested both on the final answer and/or on the subtotal answers in the long hand procedure. Several levels of complexity are provided here as well. The third module consists of division problems; one particularly nice feature of the division module is that the long hand division steps can be displayed along with the remainder in order to clearly demonstrate the procedure by which the remainder is derived. Using TEACHER'S AIDE is not merely a drill, but rather a learning experience.

ORDERING INFORMATION

All orders are processed and shipped within 48 hours. Please enclose payment with order and include the appropriate computer information. If paying by VISA or Master Card, include all numbers on card. Purchase orders accepted.

Shipping and Handling Charges
Within North America: Add $2.00
Outside North America: Add 15% (Air Mail)

Delivery
All orders (excluding books) are sent First Class.

Quantity Discounts
Deduct 10% when ordering 3 or more programs. Dealer discount schedules are available upon request.

8" CP/M Disks
Add $2.50 to the listed diskette price for each 8" floppy disk (IBM soft sectored CP/M format). Programs run under Microsoft MBASIC or BASIC-80.

5¼" CP/M Disks
All software available on 8" CP/M disks is also available on 5¼" disks, North Star format.

Ask for **DYNACOMP** programs at your local software dealer. Write for detailed descriptions of these and other programs from **DYNACOMP**.

DYNACOMP, Inc. (Dept. C)
1427 Monroe Avenue
Rochester, New York 14618
24 hour order phone: (716)442-8731 recording
Office phone (9AM-5PM EST): (716)442-8960

New York State residents please add 7% NYS sales tax.

STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) — **Price: $39.95 Cassette/$43.95 Diskette**

DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter function or choose from a menu of filter forms. The filter forms are subsequently converted into non-recursive convolution coefficients which permit rapid data processing. In the explicit design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to varying degrees according to the number of points used in the calculation. These filters may optionally also be smoothed with a Hanning function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter functions. Also included are convenient data storage, retrieval and editing procedures.

DATA SMOOTHER (Not available for Atari) — **Price: $19.95 Cassette/$23.95 Diskette**

This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**

Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) — **Price: $19.95 Cassette/$23.95 Diskette**

This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

HARMONIC ANALYZER (Available for all computers) — **Price: $24.95 Cassette/$28.95 Diskette**

HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage/retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.

FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of $49.95 (three cassettes) and $59.95 (three diskettes).

REGRESSION I (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**

REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy; an automatic degree determination option; an extensive internal library of fitting functions; data editing; automatic data, curve and residual plotting; a statistical analysis (eg: standard deviation, correlation coefficient, etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

REGRESSION II (PARAFIT) (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**

PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data, results and residuals may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

MULTILINEAR REGRESSION (MLR) (Available for all computers) — **Price: $24.95 Cassette/$28.95 Diskette**

MLR is a professional software package for analyzing data sets containing two or more linearly independent variables. Besides performing the basic regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may interrogate the solution by supplying values for the independent variables. The number of variables and data size is limited only by the available memory.

REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for $51.95 (three cassettes) or $63.95 (three diskettes).

ANOVA (Not available on Atari cassette or for PET/CBM) — **Price: $39.95 Cassette/$43.95 Diskette**

In the past the ANOVA (analysis of variance) procedure has been limited to the large mainframe computers. Now DYNACOMP has brought the power of this method to small systems. For those conversant with ANOVA, the DYNACOMP software package includes the 1-way, 2-way and N-way procedures. Also provided are the Yates 2^{K-P} factorial designs. For those unfamiliar with ANOVA, do not worry. The accompanying documentation was written in a tutorial fashion (by a professor in the subject) and serves as an excellent introduction to the subject. Accompanying ANOVA is a support program for building the data base. Included are several convenient features including data editing, deleting and appending.

BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)

DYNACOMP is the exclusive distributor for the software keyed to the popular texts *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* by F. Ruckdeschel (see advertisements in BYTE magazine). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

Volume 1
Collection #1: Chapters 2 and 3 - Data and function plotting; complex variables and functions.
Collection #2: Chapter 4 - Extended matrix and vector operations.
Collection #3: Chapters 5 and 6 - Random number generators (Poisson, Gaussian, etc.); series approximations.
Price per collection: $14.95 Cassette/$18.95 Diskette

All three collections are available for $39.95 (three cassettes) and $49.95 (three diskettes).

Volume 2
Collection #1: Chapter 1 - Linear, polynomial, multidimensional, parametric least squares.
Collection #2: Chapter 2 - Series approximation techniques (economization, inversion, reversion, shifting, etc.).
Collection #3: Chapter 3 - Functional approximations by iteration and recursion.
Collection #4: Chapter 4 - CORDIC approximations to trigonometric, hyperbolic, exponential and logarithmic functions.
Collection #5: Chapter 5 - Table interpolation, differentiation and integration (Newton, LaGrange, splines).
Collection #6: Chapter 6 - Methods for finding the real roots of functions.
Collection #7: Chapter 7 - Methods for finding the complex roots of functions.
Collection #8: Chapter 8 - Optimization by steepest descent.
Price per collection: $14.95 Cassette/$18.95 Diskette

All eight collections are available for $99.95 (eight cassettes) and $129.95 (eight diskettes).
Because the texts are a vital part of the documentation, *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* are available from DYNACOMP:

BASIC SCIENTIFIC SUBROUTINES, Vol 1 (319 pages): $19.95 + 75¢ postage
BASIC SCIENTIFIC SUBROUTINES, Vol 2 (790 pages): $23.95 + $1.50 postage

See reviews in KILOBAUD and Dr. Dobbs.

ROOTS (Available for all computers) — **Price $10.95 Cassette/$14.95 Diskette**

In a nutshell, ROOTS simultaneously determines all the zeroes of a polynomial having real coefficients. There is no limit on the degree of the polynomial, and because the procedure is iterative, the accuracy is generally very good. No initial guesses are required as input, and the calculated roots are substituted back into the polynomial and the residuals displayed.

ACTIVE CIRCUIT ANALYSIS (ACAP) (48K Apple only) — **Price: $25.95 Cassette/$29.95 Diskette**

ACAP is the analog circuit designer's answer to LOGIC SIMULATOR. With ACAP you may analyze the response of an active or passive component circuit (e.g., a transistor amplifier, band pass filter, etc.). The circuit may be probed at equal steps in frequency, and the resulting complex (i.e., real and imaginary) voltages at each component juncture examined. By plotting the magnitude of these voltages, the frequency response of a filter or amplifier may be completely determined with respect to both amplitude and phase. In addition, ACAP prints a statistical analysis of the range of voltage responses which result from tolerance variations in the components. ACAP is easy to learn and use. Simply describe the circuit in terms of the elements and their placement, and execute. Circuit descriptions may be saved onto cassette or diskette to be recalled at a later time for execution or editing. ACAP should be part of every circuit designer's program library.

LOGIC SIMULATOR (Apple only; 48K RAM) — **Price: $24.95 Cassette/$28.95 Diskette**

With LOGIC SIMULATOR you may easily test your complicated digital logic design with respect to given set of inputs to determine how well the circuit will operate. The elements which may be simulated include multiple input AND, OR, NOR, EXOR, EXNOR and NAND gates, as well as inverters, J-K and D flip-flops, and one-shots. The response of the system is available every clock cycle. Inputs may be clocked in with varying clock cycle lengths/displacements and delays may be introduced to probe for glitches and race conditions. At the user's option, a timing diagram for any given set of nodes may be plotted using HIRES graphics. Save your breadboarding until the circuit is checked by LOGIC SIMULATOR.

NUMBERKRUNCHER (TRS-80 only) — **Price: $69.95 Cassette/$73.95 Diskette**

This program is the most complete numerical analysis system available for the TRS-80. It can handle up to 255 data sets, each set having a six character name. It includes complete data editing facilities and convenient data input/output capability. The analyses available are multiple linear regression and correlation determination of residuals, data transformations and extensive graphics generation, including axis naming, and more. The supporting documentation is extremely well written and well organized, and includes appendices which describe the numerical procedures used in the program.

STATSORT (TRS-80 only) — **Price: $39.95 Cassette/$43.95 Diskette**

STATSORT consists of several menu selected programs which allow the user to create (build, edit, merge), format and print files, (machine) sort them on any field, and numerically analyze (maximum, minimum, average, variance, standard deviation) tabulated data. STATSORT is well documented and easy to use. The cassette version can also be employed to create a data type which can be read by the Radio Shack Advanced Statistical Package.

STATTEST (TRS-80 only) — **Price: $19.95 Cassette/$23.95 Diskette**

This is a statistical inference package which helps you make wise decisions in the face of uncertainty. In an interactive fashion you can build and edit data files and test the differences in means, variances and proportions. STATTEST will also perform data analysis as well as do linear correlation and regression. This menu-directed statistical workhorse is rounded out with a chi-square contingency test and a (uniform and normal) random sample generator. The documentation is written by a college professor who guides you through the various tests.

ABOUT DYNACOMP

DYNACOMP is a leading distributor of small system software with sales spanning the world (currently in excess of 50 countries). During the past three years we have greatly enlarged the DYNACOMP product line, but have maintained and improved our high level of quality and customer support. The achievement in quality is apparent from our many repeat customers and the software reviews in such publications as COMPUTRONICS, 80 Software Critique, A.N.A.L.O.G., Creative Computing and Kilobaud. Our customer support is as close as your phone. It is always friendly. The staff is highly trained and always willing to discuss products or give advice.

CIRCLE 136 ON READER SERVICE CARD

binations with which people are already familiar: alphabetical order, frequency of usage and semantic clustering. A random order of vocabulary items was used as a control. Presumably, if any of the page schemes produced a faster visual search time than random order, it was safe to conclude that it was making a page display easier to use.

Eight normal-speaking adults were used as experimental subjects in order to collect data norms to compare later with data collected from handicapped users. Subjects were timed with a stopwatch.

Based on the results from these experiments, Dr. Simpson designed the word page layouts with a syntactical pattern of columns. Alphabetical order is used for the menu items in each column, as in Figure 1.

Figure 1.

HOW	ARE	HE	BUY
HOW MUCH	CAN	I	COME
>	>	>	>
WHAT	COULD	IT	DO
WHEN	DID	SHE	EAT
WHERE	DO	THEY	GET
WHICH	DOES	WE	GO
WHO	HAS	YOU	KNOW
WHOM	HAVE		LIKE
WHOSE	IS		MAKE
WHY	SHOULD		PAY
	WERE		READ
	WILL		SAY
	WOULD		SEE
			WANT
			WATCH

The columns are question word/auxiliary verb/pronoun/verb, the syntactical order for questions in English. An additional column on the right (not shown) is a list of directions to the computer.

"I started out having pages for all the syntactic categories and pages of semantic categories, but there was so much overlap, people couldn't remember where anything was," Dr. Simpson said. "I found I couldn't remember myself. So I reduced it to the simplest possible syntax. There's a page of time words, place words, and the content words are in the dictionary in alphabetical order."

Grammatical jargon was sidestepped entirely. Suffixes are simply called "endings." Use of the dictionary is made easier because the computer remembers where it has been. Hit the return button and it will take you back to the last page at which you looked.

The Stanford Speech and Language Clinic and San Francisco State University Department of Special Education provided subjects and research assistants for the clinical evaluation of the VPSP. Five speech-handicapped people were selected and observed by the research assistants for two weeks. One week was with their usual method of communication (paper and pencil, alphabet wordboard, Handivoice 120, etc.) One week was with the VPSP. In each case, the VPSP proved faster than their old methods. One cerebral palsy victim was even using the VPSP to write poetry.

For one subject, Sally Melanephy, a young mother who suffers from distonia, a disease which causes progressive loss of muscle tone, the use of the VPSP was more than helpful. It was life-changing. Mrs. Melanephy took the VPSP to college with her, and through her new-found ability to communicate, was put in touch with another victim of distonia who told her about an experimental new treatment at Stanford Medical School. After six to eight months of treatment, her muscle tone improved enough to allow her to get back her driver's license, ride a ten-speed bike and speak (somewhat).

Improvement

However, not all the stories have such happy endings. Single switch users who could not control their muscles well enough to operate the switch at the proper time reported a great deal of frustration. These were mainly cerebral palsy victims who were always hitting the switch just before or just after they wanted to.

"There has to be a better way to get the cursor under their control," Dr. Simpson said.

And in fact, they now have funding for a new project to design something better for people with these problems. A voice-controlled computer is one possibility. The user wouldn't need to speak intelligibly; he'd need only be able to make one consistent sound that could be used to activate the switch.

Some changes are also projected in the hardware. The bulky TV set and the floppy disk will have to go, the designers say.

The biggest problems that engineering consultant Charles Lingel had to contend with were the power supply and cooling. At first, they tried to get by without a fan, but it was just too hot.

"Our disks looked like phonograph records left out in the sun," Dr. Williams said. "So we put in a fan, but there were still hot spots. We had to use some of the techniques used to redirect airflow in aircraft."

Before a manufacturing prototype is made, they plan to replace the disks with, possibly, bubble memory or electrically alterable ROM. The TV set, heavy, bulky and subject to accidental bumping, has no suitable replacement as yet. But the new flat screen, with liquid crystal display sets may offer a solution. Eventually, the entire VPSP will be reduced to briefcase size so that it can be carried around by ambulatory users as well as mounted on wheelchairs.

How much will all this cost?

The inventors guess that it will be comparable in price to a good home computer system. But as the price of computer hardware decreases, it is difficult to say how much that will be by the time the VPSP is ready for sale. For example, the price of Votrax was $7,000 at the start of the project; now, it costs $1,000. A manufacturer could make it even more cheaply by buying just the chips in volume from Votrax.

Children's Hospital, Stanford, owns the rights to the VPSP; it will give them away to a manufacturer.

Children's Hospital, Stanford, owns the rights to the VPSP; it will give them away to a manufacturer in exchange for a promise to make the prosthesis with all its capabilities intact. So far, there have been no takers. One problem is that the entire field of voice prosthesis is so new that many third-party payers don't even recognize the VPSP as a prosthesis.

"Non-speaking people have mixed disabilities—cerebral palsy, strokes, neurological diseases," said Maurice LeBlanc. "No one organization speaks for them. And since they're non-vocal, they can't speak for themselves. It's a population whose needs have not been well addressed."

Meanwhile, the VPSP is not totally idle. It is being used at Children's Hospital to communicate with patients who come in to be evaluated for other speech aids.

As so often happens, technology is way ahead of society's readiness to make use of it. For those who could benefit from the VPSP, let's hope it's just a matter of time before they have it. □

DB MASTER.™ THE TOP SELLING DATA BASE MANAGER JUST GOT BETTER.

In less than a year, DB MASTER has become the top selling data base manager for the Apple II. And for good reason. DB MASTER has the features that make information management easy and efficient. But we didn't stop there. You asked for more features. We listened—and made DB MASTER even better.

MORE FEATURES IN DB MASTER VERSION THREE.

Computed Fields. Perfect for accounts receivable, inventory control and similar applications. Each record may now include up to 10 computed fields. And field values are automatically re-computed and displayed each time a record is edited.

Totaling in the Search Mode. Tell DB MASTER which field to total and which records to use. A running summary of records found and the field's sum, average and standard deviation are displayed on the screen.

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CIRCLE 242 ON READER SERVICE CARD

TYPE CASTING

David Lubar

"We're going to be doing all our typesetting right here, on TRS-80's." That was just one of the many statements I heard back in June of 1980 when I started with *Creative*, and I didn't pay much attention to it at the time. I had no hint that computerized typesetting and I would become linked in a turbulent affair which would span months of frustration, triumph and despair.

The prototype system arrived a few days later. Gathered with a crowd of onlookers, I watched as the three crucial components were integrated. There was the familiar TRS-80 Model I with expansion interface and two disk drives, there was an Alpha Comp typesetting machine, and lying between them, the G2 interface. It was, indeed, a prototype, housed in a cardboard box and hand labelled. The interface took ASCII data from Electric Pencil or Scripsit files and translated it into codes understandable by the Alpha Comp. The box was the heart and brains of the system. The box was the crucial link. The box almost worked.

Irwin Gretsco, father of the G2 interface, gave us a demonstration. "Now is the time for all good men to come to the aid of their party," he typed on the TRS-80. This was followed by a few control codes. and a few instructions to the Alpha Comp. "Here it comes," he said. We all craned forward, staring at the single-line LED display of the typesetting machine. There were hums and whirrs. Letters appeared, showing the text being set. "Now is the time for all goo men tocome tothe aid of their party."

Irwin mumbled something and proceeded to make a few solder changes in the interface, ignoring the suggestion that he might want to turn off the power first. Another runthrough produced similar results. We were informed that there must be heavy industry in the area fouling up the power lines. Since our heavy industry neighbors at the time were a pizzeria and a deli, this didn't seem likely. The trouble was finally traced to a bad cable, and glitch number one vanished; making way for glitch number two. Fortunately, these early glitches soon gave way to transient problems which, while harder to trace, did less damage.

We began typesetting on premises (and on the premise that a new interface would take care of the problems in the prototype unit). The system still garbled an occasional line, but worked well enough to cut down on the amount of work being sent out for typesetting. A new interface was delivered within a few weeks. This one had a metal case, and wreaked no havoc on misquotes of Thomas Paine. The typesetters were getting used to the system, learning the meaning of DOS ERROR 22, and the value of triple backup disks. One could become an instant hero by reviving a dead disk. The people in typesetting and software discovered the meaning of synergy. Technology had finally caught up with us.

Still, the box had a habit of breaking down just before an issue deadline, producing frantic trips to the "professional" typesetter. The third box had even more bugs ironed out, and everything finally seemed to run smoothly. Well, not quite. Now that the box was working, it was time for the Alpha Comp to go flaky. I had the misfortune of being present during the first paper jam.

The fix involved turning the monster on its side, removing innumerable screws, and carefully peeling away pieces of paper from a razor-sharp knife poised on a spring control. Volunteering for the job once, I was blessed with it for life. Meanwhile, the typesetters were learning new joys, such as end-of-paper lights that didn't go on, fonts that couldn't tolerate any dust, and other random problems. But the thrill of seeing type roll out of the processor somehow made up for these minor aggravations.

There is a happy ending to this phase of the story. The system works almost all the time, allowing us to set the entire magazine, along with *Microsystems* and *SYNC*, right down the hall from the editorial offices. Between magazines, the typesetters also manage to set many of the new books published by Creative Computing Press, and all the documentation for Creative Computing Software packages. In-house typesetting definitely gives a boost to productivity.

Soon after this, the company moved to larger headquarters, taking over a building that had previously been a printing plant. In one of the rooms, as if a reminder of how far we'd come, sat a huge beast known as a hot-lead machine. This combination furnace and die caster creates type from molten metal, and probably doubles as a sauna. After a consultation with our efficiency expert, we decided to ignore the machine and stick with computers.

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CIRCLE 240 ON READER SERVICE CARD

Eight Inch Blues

So, the system could take anything written under Electric Pencil or Scripsit and turn the text into typeset strips. That was fine for the typesetters, but left the editorial staff with one small problem. Most of us use systems with eight-inch disks. For example, the system I had inherited from my predecessor was an Altair running Electric Pencil under CP/M; the editor uses a SOL, the publisher has an Imsai, and two other eight-inch CP/M systems were lurking about. We had been told that the typesetting system might be able to handle eight-inch disks, but had no clue as to how to achieve that goal. Dual Omicron drives had been connected to the TRS-80 when the system was first set up. This allowed data to be read into the computer, but didn't seem to catch the attention or interest of the interface. Our resident hardware man at the time was sure he could effect a simple solution. Unfortunately, his efforts, over a period of a month, left us with a fix that did nothing whatsoever. He is no longer with us.

Determined to continue using the Altair, I got together with a software pro and decided to trash the original approach, starting fresh. Together, we came up with an idea that actually worked; just send the file right to the interface using the CP/M TYPE command. The next day, text was streaming off eight inch disks in typesetting. Those of us using Altairs, Imsais, and other vintage models breathed a sigh of relief. Those four-thousand word articles no longer had to be split into several disk files, and DOS ERROR 22 no longer reared its ugly head. Now, if I could only find out what's wrong with the top area of RAM in the Altair....

Changes

A few months after the eight-inch problem was resolved, the now-flaky TRS-80 was replaced with a seemingly more reliable LNW. This killed the eight-inch interface, making it necessary to download ASCII files from the Altair to a TRS-80, using LDOS, then take these files to the LNW. (If that description sounds to you like alphabet soup, you aren't alone.)

While the above may suggest that there are a few problems with the system, there are also definite advantages. The ability to keep track of a manuscript from start to finish is a great asset for any magazine. Also, duplication of work is avoided. When one of the staff writes an article, it doesn't have to be re-typed by the typesetting department. They can take the text right from the disk. Those horrendous monthly deadlines can be extended slightly because of the time saved here, so articles that would have been two weeks late are now only one week late. Eventually, we plan to set up a system that will translate files from any disk format. Already, some manuscripts for *Microsystems* and *Creative Computing* are taken straight from the author's disks, though it might be some time before the process is applied to *SYNC* magazine. The next step might be modems; we'll keep you posted. ☐

FROM TEXT TO TYPE

Text can either be entered directly into the Alpha Comp, or placed on disk first. The disk storage is preferrable for articles since it simplifies changes. The text contains embedded commands for the typesetting machine. For example, the equal sign indicates the start of a paragraph, and the percentage sign marks the end of a paragraph. The obvious question from here is, what if you want to print one of the reserved signs? This is taken care of by the memory capability of the Alpha Comp. It can store up to 1024 reserved characters. These memory fills are designated in the text with the symbols @N@, where N indicates which character to use. For instance, if a % is needed in the text, it can be designated as memory fill number 1. Then, whenever the text contains the symbols @1@, it will print a percentage sign. While this might seem to be a bit of a bother to enter into the text, don't forget that text is entered under Electric Pencil. Global search and replace takes the drudgery out of such tasks. The font is also controlled by text commands. A typical font disk for the Alpha Comp (this is the delicate item, dust being attracted to the combination of glass and film) contains three typefaces, usually standard, italic, and bold. With a command embedded in the text, the font can be changed at any time. One sentence can be in normal type. *The next can be in italics.* And another sentence or word can be in **boldface** type.

After the text is entered, hardcopy is produced and sent around for final editing. The changes are made on the disk, and it's time to typeset. First, the Alpha Comp is turned on, and any memory fills are defined. Then the command mode of Electric Pencil is used to set print parameters. Next, with a simple control-P, the characters start flowing through the interface and into the Alpha Comp. The flow continues without interruption unless a word won't fit on the end of a line. In such cases, the Alpha Comp beeps and waits patiently for the operator to hyphenate the word. Optional hyphens can be inserted allowing the machine to select the break which will produce the most even line of print. The text appears in a small window, and is sent to special paper inside the machine. After the text is finished, the paper is removed and put through a processor. This device, which resembles a mangler and is filled with chemicals that can strip the flesh from mortal bones, magically turns strips of paper into useable type. *Voila!* The article is typeset and ready for the art department. The entire process takes place within these very walls. From manuscript to camera-ready boards, we do it all for you.

Sample text with embedded commands.

```
The font is also controlled by text commands. A typical font disk for the Alpha
Comp (this is the delicate item, dust being attracted to the combination of
glass and film) contains three typefaces, usually standard, italic, and bold.
With a command embedded in the text, the font can be changed at any time. One
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New RAMS for Old

Steve Olsson

The procedure outlined below enables adventuresome Atari users to upgrade 8K memory boards to 16K. While savings of up to $100 per board are possible, users should be aware that this modification voids the warranty on the memory boards.

If you have an Atari 800 with two 8K memory boards and don't want to upgrade memory by throwing away two expensive modules, you can now upgrade them to two 16Ks for a fraction of the cost of new 16K boards. This upgrade can be done by almost anyone, and does not require extensive hardware knowledge. All it takes is a bit of soldering. The theory is as follows:

The 4116 dynamic memory is a very popular memory chip used by, among others, Apple, TRS-80, and Atari. This chip is inexpensive and readily available. It is arranged as a 16K x 1 in a sixteen pin DIP and comes in many different speeds.

The 4116 memory also has a half brother, the 4108. The 4108 is very similar to the 4116, except it is arranged as an 8K x 1. In reality, the 4108 chip is a 4116. Besides the label, there is only one real difference: the 4108 is a 4116 that has a problem. When the chips are manufactured, bad ones are thrown into the reject pile and good ones are shipped. From the reject pile some chips are again sorted and shipped. Chips with the upper half bad and lower half good are sold as 4108-A, and those with the upper half good are sold as 4108-B.

Atari now buys a 4108 chip and accesses only the good half of it on the 8K memory board. If Atari were to install completely good 4116 memory chips and access the entire chip, a 16K memory board would result.

The point is, instead of throwing away the 8K module (which is nearly identical to the 16K module), why not replace the 8K memory chips with 16K memory chips? Several jumper options must be changed, and the 8K memory must be removed from its sockets and replaced with 4116s. The whole process is extremely easy and should take about 30 minutes.

In order to begin the procedure, the first thing to do is order eight 4116 RAMS per board being upgraded from a local supply house. (Care must be taken to choose a reputable supplier. The parts should be guaranteed 100% operational). The cost of the chips ranges from $30 to $60. The chips must to have a maximum access time of 200 nS in order to work in the Atari.

Once the 4116s are in hand, open the top of the Atari and remove an 8K memory module. Remove the two screws that hold the memory module together. Pop off the metal cover and snap open the module along the edge connector. The circuit board now lifts out of the module.

Six jumpers on the front (component side) of the board labeled A, B, C, D, E, F are now exposed. They are actually resistors of very low value but function as jumpers only.

The edge connector is labeled 1-22 on the front and A-Z on the back. (Notice omitted letters G, O, Q, I due to similarities

---

Steve Olsson, 3392 Clipper Dr., Chino, CA 91710.

in shape.) The letters connected together by small pieces of etch are: U-T, S-R, and N-P. Also notice the etch from W to Z501 pin 15. All of these small etches must be completely removed with a razor blade or X-acto knife.

Atari was nice enough to add solder holes to all of the connections which must now be soldered. Connectors to be soldered together with small pieces of wire are: Z501 pin 15-U, T-S, P-R, and M-N.

On the front side of the board, jumper C must be installed and all other jumpers removed. On the back of the board a very small solder connection must be made to the connector H as far away from the edge as possible. This wire must be added to hook that signal to jumper D on the side next to the letter (as shown in Figure 4). Make this connection from the back of the board even though the letter is on the front of the board.

Program 1.

```
 10   GRAPHICS 8
 20   SETCOLOR 2,0,0
 30   COLOR 1
 40   FOR Y=0 TO 159
 50   PLOT 0,Y
 60   DRAW TO 319,Y
 70   NEXT Y
```

The next step is to remove the 8 DIPs labeled C503, C505, C507, C509, C511, C513, C515, and C517 from their sockets and replace them with the 4116s. Replace the board in the module, screw it back together, and the modification is finished!

In order to test the memory, use the following procedures: Insert only the module under test into the Atari then use the ?FRE(0) command to see if the Atari recognizes an increase in memory. If everything looks OK at this point, use graphics 8 mode. Type SETCOLOR 2, 0, 0, which makes the background black. If no spots appear, make the screen white by using Program 1. If, after running this program, there are no holes in the screen pattern, assume the last 8K of memory has no solid errors.

Program 2.

```
  2   X1=14*256
  4   X2=65*256
  6   X=14
 10   POKE 106,X:GRAPHICS 0
 20   FOR X=X1 TO X2
 30   POKE X,255
 40   NEXT X
 45   FOR X=X1 to X2
 50   IF PEEK (X)<>255 THEN PRINT
"ERR-";X
 60   POKE X,0
 70   NEXT X
 80   FOR X=X1 TO X2
 90   IF PEEK (X)<>0 THEN PRINT
"ERR-";X
100   NEXT X
```

After this test run Program 2 to check more of the memory. This program checks each memory location (without interfering with Basic) and reports failures to the screen. A few failures could mean there are some bad chips; many failures probably mean the module was wired wrong or the chips are very bad. The failure will probably have to be determined from the failure report generated by Program 2, which reports the address of failure. PEEK and POKE must be used to determine which bit is bad. Program 2 cannot check the first 5K of memory in the module, but if the program runs without strange things happening it is probably all right.

If a memory board is known to be good, place it in slot 1 in memory. If the total memory is now 24K, change lines in Program 2 to:

2 X1 = 32*256
4 X2 = 96*256
6 X = 32

If the total memory is 32K, change lines in Program 2 to:

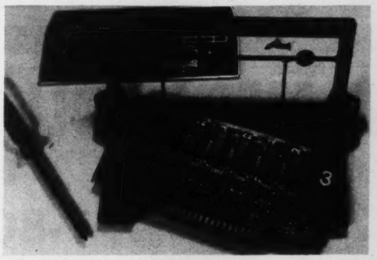
2 X1 = 64*256
4 X2 =128*256
6 X = 64

The program can now be run. This will completely test the new memory module, and will take about 10-14 minutes to run. If you had only one 8K module that is now a sixteen, you will have to hope the first 5K of memory is good until you get more. The first 5K is impossible to test with only one module.

If your computer passes all these tests, the memory in your Atari has just been doubled. If you have any trouble that is not understandable and have rechecked the procedure to verify that it was done right, you probably have bad RAMs.

This simple procedure will, I hope, save many people lots of money, allowing them to operate with a disk drive and have plenty of memory left for the other programs. □

Photo 1. The open 8K module.
Photo 2. The component side of the memory board.
Photo 3. Close up of the jumpers A-F.
Photo 4. Correctly installed 16K jumpers on back of board.
Photo 5. The etch side of the completed mod.



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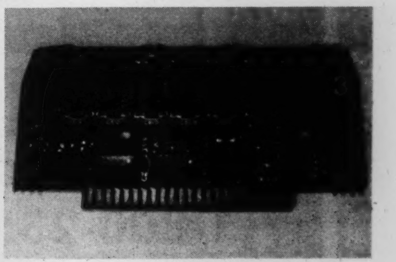

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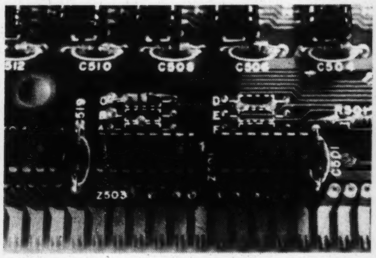

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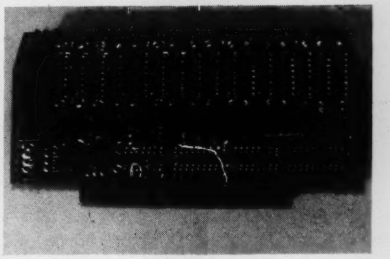

Photo 4.

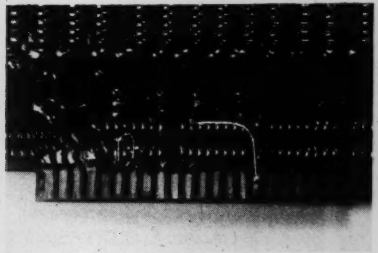

Photo 5.

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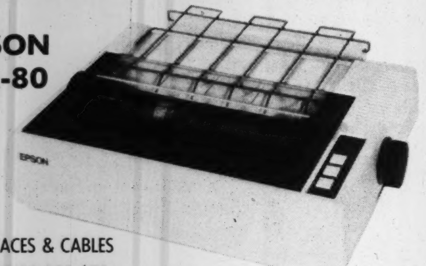

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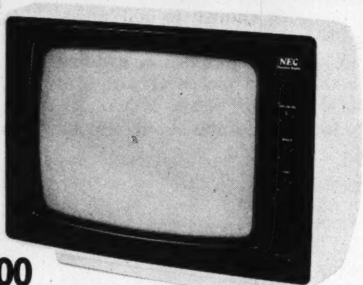

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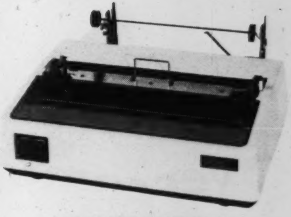

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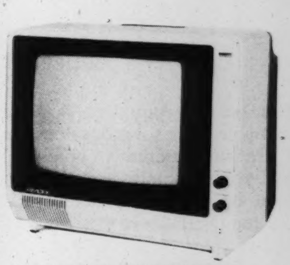

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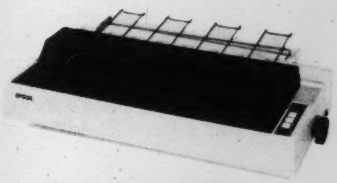

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CIRCLE 213 ON READER SERVICE CARD

Overcoming Blocks and Barriers to Creativity

Part 1: Eliminating Psychological Blocks

Eugene Raudsepp

Just because you find it difficult to develop creative solutions does not mean you are without creative potential. More likely, your problems are due to psychological or organizational obstacles that block the flexibility of thought that makes creativity possible. Once these obstacles are recognized and removed, a considerable upsurge in creative output can be realized.

The most serious obstacles to creative thinking are psychological in nature. Not only are these obstacles the hardest to recognize, but overcoming them usually requires changing basic personality traits that have been many years in the making. To accomplish such change, you must be willing to examine yourself honestly and substitute more flexible ideas and attitudes for those that are proving to be restrictive.

Know, and Be, Yourself

Every person has an inner self from which his creativity flows. When an individual taps this core, he unlocks a vast reservoir of submerged ideas and feelings that enable him to take charge of his life and to think creatively. He no longer needs to blame other people, "the situation," or fate when things go wrong; he does not feel he is a "victim of circumstances." Instead, he can use his own resources to solve life or work problems in a creative manner.

The road to self-knowledge and the expression of true individuality and creativity is not easy. In his therapeutic technique, psychologist Carl Rogers encourages people to act as they really think and feel, without resorting to the false masks and roles upon which they are used to relying. Many people exist only in response to the demands and expectations of others. They seem to have no selves of their own. They think, feel, and behave in the ways that others want them to. According to Rogers, once a person realizes how much of his inner and outer life is predicated on what *others* believe he should be or do rather than on what *he* wants to be and do, he is on the road to self-discovery.

Self-knowledge also includes a knowledge of the impression you make on others. As soon as two people come into contact—at a party, business lunch, job interview, etc.—they form an impression of each other. Whether positive or negative, this impression, formed in the first few minutes, is usually hard to change. One seldom gets a second chance to make a "first" impression. By finding out how you impress people, you can determine how well your true self is getting across.

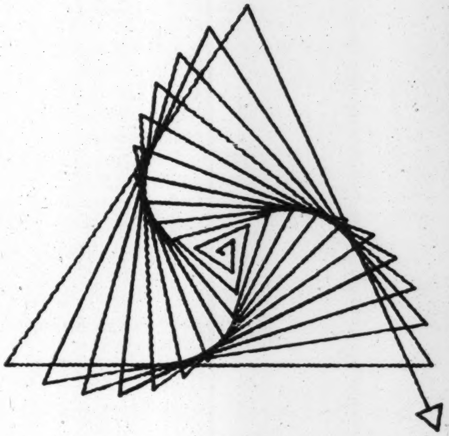
One easy and interesting way to gauge your impact on people is to conduct an informal survey. Make a list of 25 to 30 important personality traits. The list should include such qualities as "energetic," "decisive," "understanding," "dominant," "critical," etc. Distribute the list to several friends and acquaintances. Ask each participant to check the four traits from the list that best describe himself as he believes others see him most of the time. Next, ask them to check the four characteristics they think best describe each of the other participants (yourself included). If the exercise is being conducted in a group, each person can explain why he rated himself and others as he did.

Most people are more concerned with the negative than the positive aspects of life.

Eugene Raudsepp, 10 Nassau St., P.O. Box 122, Princeton, NJ 08540.

LOGO

POWERFUL IDEAS IN MIND-SIZED BYTES



```
TO POLYSPI :SIDE :ANGLE :INC
FORWARD :SIDE
RIGHT :ANGLE
POLYSPI :SIDE+:INC :ANGLE :INC
END

POLYSPI 1 123 3
```

This drawing was made by this program using LOGO's "turtle graphics".

The turtle is a Logo-controlled "cybernetic toy" that draws lines as it moves across the TV screen. Directing the turtle to construct graphic designs, programmers simultaneously confront aesthetic and mathematical issues.

Logo is more than turtle graphics. Logo was designed to put some of the powerful ideas of computer science at your disposal— ideas like procedure, process, local and global variables, list processing, recursion, etc. Its syntax is simple enough that beginners can write procedures in a first session, yet Logo is extensible and provides the means to tackle advanced and sophisticated projects.

Logo has often been described as a language for children. It is so, but in the same sense that English is a language for children, a sense that does not preclude its being ALSO a language for poets, scientists, and philosophers.

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CIRCLE 184 ON READER SERVICE CARD

Creativity, continued...

Accentuate the Positive

In a recent study I conducted with over 1400 people from all walks of life, participants were asked to list some of the most pleasant and unpleasant things that had happened to them during their lifetimes. The result was surprising. In almost every case, the pleasant happenings were dispensed with in a few short sentences, while the unpleasant happenings elicited long and elaborate essays. This simple exercise confirmed that most people are more concerned with the negative than the positive aspects of life.

Many apparently urgent problems and obsessive negative feelings are best "solved" by temporarily forgetting them.

Chronic negativity inhibits creativity. For example, one of the basic requirements for creativity is receptive concentration. But this mental state cannot be achieved if a person is constantly bothered by past frustrations and resentments. Such a preoccupation will inhibit the flow of new ideas and feelings that provide the fresh perspectives from which creative solutions evolve.

Paradoxical as it may seem, many apparently urgent problems and obsessive negative feelings are best "solved" by temporarily forgetting them. Such deferment allows a person to bypass the negatives that inhibit creative thought and get on with the problems and issues that are more immediately amenable to solution. By substituting a constructive, creative activity for negativistic brooding, a person can more easily tap his constructive resources, and seemingly insurmountable problems will shrink to their proper size. Then, with the confidence that comes from constructive and productive action, the original problems (if they are still there) can be solved calmly and systematically.

Of course, the best way to deal with chronic negative attitudes is to analyze them and eliminate them once and for all. But this can't be done if you don't know what they are.

One of the most useful ways to make you aware of your true attitudes and feelings is the incomplete-sentence exercise. While a direct question about a personal subject often produces a censored or distorted response (even in the privacy of one's own mind), the incomplete-sentence exercise usually elicits an honest response.

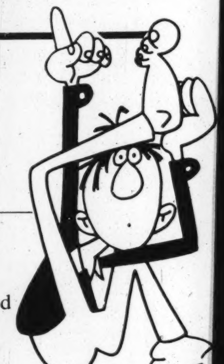
Here are some examples of how one incomplete sentence might be completed: When people disagree with me ... I disagree with them just to get even; I think they must be right; I think they're stupid. Typical incomplete sentences that might be used in such an exercise include: When I make a mistake, I ...; When I'm criticized, I ...; My future seems ...; Self-respect comes from ...; When people interrupt me, I ...; When I'm under stress ...; What I need most for my own development is ...

Approach Problems as Challenges

Many people consider the ideal condition of life to be a nirvana-like state of untroubled bliss. But this is short-sighted and self-defeating. People are not vegetables; they are thinking and feeling beings, who are constantly trying to improve their present situations. Thus, problems are an integral and essential part of living that act as challenges to test and develop a person's creative capacities. The healthy individual welcomes such challenges for the gratifying experience of gaining mastery over them.

Most non-creative people have one trait in common: they are passive. They *react* to events and situations, rather than *acting* to bring about new circumstances. They expect fate to hand them a trouble-free existence. When problems occur, they blame outside circumstances or other people for their unhappiness. They cannot see or admit that the real cause of their discontent lies within themselves. Even if external circumstances are difficult it is an unwillingness to do something effective about a situation that allows a feeling of unhappiness to persist. Only when a person decides to break out of his self-negating rut—when he begins to tackle his problems head-on—will he begin to lay a firm foundation for his psychological health and creativity.

Most creative people possess a spirit of adventure, a genuine willingness to take chances.



How Early Conditioning Stifles Creativity

Creativity can be blocked early in life through the unthinking remarks and actions of adults. Consider the example of a ten-year old girl who is trying to write stories. When the child attempts to get her mother interested in her efforts, the mother asks, "Who would want to read what a ten-year old would write?" After several rebuffs such as this, the child comes to believe that her attempts at writing are worthless. If such a pattern is repeated with other projects, the child will "learn" that creative effort can bring only disappointment and ridicule.

The early stifling of creativity is not always so direct and obvious, however. To illustrate more subtle negative conditioning, consider the case of a boy who begs his father for a house for his dog. The boy looks forward with great anticipation to the day when he and his father will build the doghouse together. But the father does not want his son "in the way," so he assembles the doghouse when his son is away. The boy returns home to find the job completed. His disappointment is lost on the father who is pleased with himself at having completed the project successfully. The father probably lacked the patience that would have been required to allow his son to develop his building skills. Such "put downs" are guaranteed to inhibit creativity.

Perhaps the surest way to block the development of creativity in young people is illustrated in the story of a young man who is beset by doubt and feelings of inferiority because his parents repeatedly ask him, "Do you really think you can do it?" whenever he undertakes an interesting project. Their distrust of his ability to have a useful idea or to succeed in a constructive endeavor eventually infiltrates his mind to the point that he becomes paralyzed whenever original thought or decisive action is called for.

Such early experiences create the fears, guilts, and inhibitions that are inimical to creativity. Not only are these "wounded" people fearful of criticism, but attempts on their part to be creative evoke guilt-feelings about competing with, or even attempting to depose, a parental figure from its position of authority.

Make the Most of Your ZX81 or 80

SYNC Magazine

SYNC, a bi-monthly magazine for users and prospective users of the Sinclair ZX80 computer has expanded its coverage to include the ZX81 as well.

Now entering its second year, **SYNC** has been providing nearly 10,000 Sinclair computer owners with information on how to make most effective use of their computers. "Resources," one of the most popular sections of the magazine, has listed over 100 second source vendors of software, peripherals and books as well as user groups.

Each issue of the magazine carries complete application programs, tips and techniques for more effective programming, hardware modifications and in-depth evaluations of software, peripherals and books.

Subscriptions to **SYNC** cost $10.00 per year (6 issues). **SYNC**, 39 E. Hanover Ave., Morris Plains, NJ 07950. (201) 540-0445.

The ZX81 Companion

The ZX81 Companion by Bob Maunder follows the same format as the popular **ZX80 Companion**. The book assists ZX81 users in four application areas: graphics, information retrieval, education and games. The book includes scores of fully documented listings of short routines as well as complete programs. For the serious user, the book also includes a disassembled listing of the ZX81 ROM Monitor.

MUSE reviewed the book and said, "Bob Maunder's **ZX80 Companion** was rightly recognized to be one of the best books published on progressive use of Sinclair's first micro. This is likely to gain a similar reputation. In its 130 pages, his attempt to show meaningful uses of the machine is brilliantly successful."

"The book has four sections with the author exploring in turn interactive graphics (gaming), information retrieval, educational computing, and the ZX81 monitor. In each case the exploration is thoughtfully written, detailed, and illustrated with meaningful programs. The educational section is the same—Bob Maunder is a teacher—and here we find sensible ideas tips, warnings and programs too."

Softbound, 5 1/2 x 8", 132 pages, $8.95.

The Gateway Guide to the ZX81 and ZX80

The Gateway Guide to the ZX81 and ZX80 by Mark Charlton contains more than 70 fully documented and explained programs for the ZX81 (or 8K ZX80). The book is a "doing book," rather than a reading one and the author encourages the reader to try things out as he goes. The book starts at a low level and assumes the ZX80 or ZX81 is the reader's first computer. However by the end, the reader will have become quite proficient.

The majority of programs in the books were written deliberately to make them easily convertible from machine to machine (ZX81, 4K ZX80 or 1K ZX80) so no matter which you have, you'll find many programs which you can run right away.

The book describes each function and statement in turn, illustrates it in a demonstration routine or program and then combines it with previously discussed material.

Softbound, 5 1/2 x 8", 172 pages, $8.95.

Getting Acquainted With Your ZX81

This book is aimed at helping the newcomer make most effective use of his ZX81. As you work your way through it, your program library will grow (more than 70 programs) along with your understanding of Basic.

The book is chock full of games such as *Checkers* which draws the entire board on the screen. Other games include Alien Imploders, Blastermind, Moon Lander, Breakout, Digital Clock, Roller-Ball, Derby Day, and Star Burst.

But the book is not all games. It describes the use of PLOT and UNPLOT, SCROLL, arrays, TAB, PRINT AT, INKEY$, random numbers and PEEK and POKE. You'll find programs to print cascading sine waves, tables and graphs; to solve quadratic equations; to sort data; to compute interest and much more.

Softbound, 5 1/2 x 8", 120 pages $8.95.

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CIRCLE 215 ON READER SERVICE CARD

Creativity, continued...

Most creative people possess a spirit of adventure, a genuine willingness to take chances. By adopting this attitude, they free their imaginations and conquer the fear of failure or disappointment. The essence of creativity lies in the willingness to occasionally leap into the unknown, to *relinquish* temporarily the rigid routine that usually characterizes a person's thoughts and actions.

Use Experience to Build Self-Confidence

The role that self-confidence plays in developing a person's creative potential cannot be over-estimated. A lack of self-confidence can manifest itself in several ways: an inability to take criticism, doubt about one's own abilities, and fears about being compared unfavorably with others, appearing foolish or unusual, or failing to fulfill a commitment.

Developing the confidence to establish and maintain a detachment from negative opinion is very difficult. Yet this daring to transcend accepted patterns of thinking, call one's own shots, and stick to one's convictions in the face of possible censure is the very essence of creative work.

> ***However tough a person may appear to be, his thinking will almost surely be inhibited by pre-emptive criticism, ridicule, or indifference.***

Self-confidence can be best developed through experience, but that experience need not be successful to be beneficial. Although it is true that nothing breeds success like success, the corollary that failure necessarily breeds failure is not true. If failures are analyzed and overcome, self-confidence can be greatly improved.

Self-confidence is hard to develop on one's own. Young people, especially, need healthy doses of encouragement and ego-boosting in order to develop a confidence that they will succeed eventually, no matter how many times they fail initially. Once they develop such confidence, they will no longer see problems as threats. They will be able to approach and weigh situations realistically and be willing to risk failure as they search for new and different solutions.

One of the best ways to restore or improve self-confidence is to take stock of past achievement. An achievement is something to be proud of. Contemplating and analyzing past successes can marshal one's creative resources and point the way to future accomplishment.

With this in mind, briefly write down four of your most significant achievements to date, either on the job or in your life. Describe what was achieved in each case, why you did it, when you did it, where you did it, who was involved, and what difficulties were overcome. Next, decide which of the four is your most important achievement. Would you want to do it again? Could you surpass it today? Then write down the next achievement you want to accomplish. Determine what must be done to bring about this achievement.

Learn to Handle Criticism

In a sense, creativity is destructive to established ways of thinking and doing things. And since there is a natural human tendency to maintain the status quo, new ideas or approaches will invariably be met with criticism and, perhaps, even censorship.

Most people resent any direct or implied criticism of their ideas; they seldom have an unemotional, objective attitude about their ideas, or can benefit from justified criticism and ignore the rest. However tough a person may appear to be, his thinking will almost surely be inhibited by pre-emptive criticism, ridicule, or indifference. In extreme cases, such rebuffs can produce a "creative drought" in a person—a period in which no new ideas emerge, even in the privacy of his own mind.

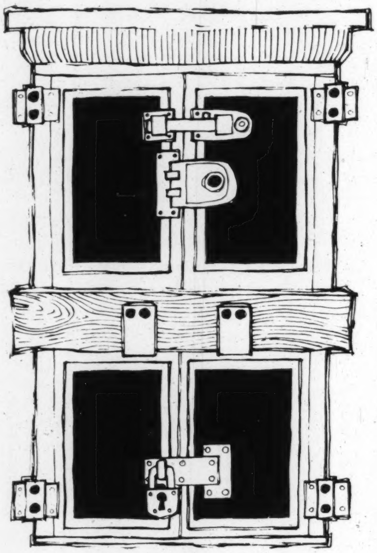
The first step in learning to handle criticism is to distinguish between the content and the intent of criticism. People are subject to a variety of pressures that sometimes make them behave irrationally and destructively. Thus, their criticisms are sometimes aimed at the person offering a new idea, and not at the idea itself. Once you attain a certain amount of detachment from your creative efforts, you will be able to respond to the constructive comments, while ignoring the petty or misplaced ones.

Sometimes criticism evokes more than resentment in a person; it becomes a threat to his self-esteem. This is because people fear making fools of themselves. Thus, a situation in which you are presenting a new idea will probably produce a certain amount of anxiety because of an uncertainty about the true merits of the idea. Recognizing that such anxiety is likely to occur can help you to reduce its damaging effects on your creative efforts.

Develop a Personal Standard of Success

Ask people you know to describe what success means to them, and the chances are that the great majority of responses will fall into the category of "material acquisitions." Yet, these same people will probably not attribute their happiness and well-being to material wealth. This merely emphasizes the truth that the quest for material goods is rarely satisfying in itself. The person who believes otherwise will find himself preoccupied with goals and skills which are more conducive to playing politics than being creative.

> ***Carried to extremes, togetherness can result in a loss of individuality.***



For example, a preoccupation with acquiring material wealth encourages many people to be shrewd, ruthless, and expedient. Such people are frequently insensitive toward others and possess an opportunistic, self-seeking streak that pervades almost everything they do. They often end up willing to distort and compromise their values and convictions to curry favor with those in positions of power. By denying their real selves, they become the repositories of other people's expectations and demands.

In the final analysis, success is a personal ideal. It can be a physical, social, intellectual, or aesthetic experience—whatever makes a person feel effective, good, or important. While the creative individual has a strong success-orientation, it is directed toward extending the range of quality of experiences that bring him a sense of accomplishment and a feeling of self-fulfillment. His life requires an endless sequence of new challenges.

Related to the mistake of adopting the standards of others is the tendency to compare one's achievements with the

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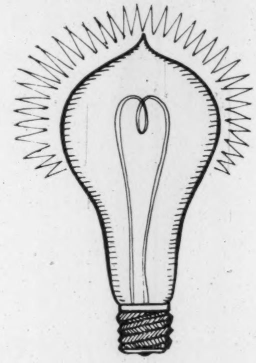
Creativity, continued...



accomplishments of others. The creative individual is true to himself. Because he has a realistic appreciation of his capacities as well as an awareness of his limitations, he is in competition only with himself and his previous creative accomplishments. He understands that there are so many gradations of ability and success that simple comparisons are impossible to make.

There is no surer way to diminish the joy of creative accomplishment than to compare what you have achieved with the accomplishments of someone else. An individual who makes a habit of doing this will never really appreciate his past achievements and will tend to minimize the effort he puts into future ones.

Put a Little Privacy in Your Life

Many people have an all-pervading fear of being alone. Being alone or doing things alone makes them feel odd or disliked. The result is that most personal and work activities are planned in such a way as to foster a false sense of togetherness. Carried to extremes, togetherness can result in a loss of individuality. People's personalities will tend to mirror only what goes on in their environment, conforming to the dictates of current values and fads.

To think and work creatively, privacy must be an integral part of your life and work. You should retreat periodically from the tensions of collectively living and doing. In addition to enabling you to regain a true perspective of your life and work, it will provide you with the solitary leisure so necessary for meaningful creative thought. ☐

Next month, Mr. Raudsepp looks at ways of overcoming organizational barriers to creativity.

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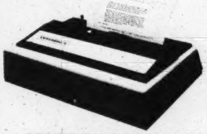

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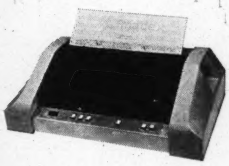

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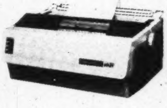

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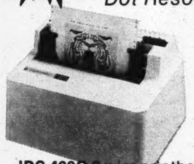

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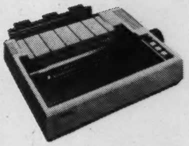

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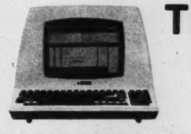

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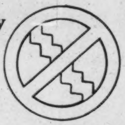
A quiet but dominating presence at the Siggraph conference, described here, were perhaps two dozen delegates from a galaxy far, far away: Lucasfilms, a big spread north of San Francisco where Jedi Master George Lucas is putting together *the* computer graphics studio.

All we know for sure is that a great deal of money, rumored to be in the neighborhood of twenty million dollars, is going into it. But what we may surmise has staggering implications for the film and television industry, and for the whole culture of the world. Because the equipment and programs that can now be assembled will be able to mimic with absolute realism any rigid scenery, props, lighting—rockets, planets, mountains. These can easily be blended and matted with motion-picture photographs from numerous sources to produce effects previously inconceivable, at low cost.

And not much further on lies the realistic simulation of writhing monsters, landscapes with trees, even realistic human actors.

Only a few small steps stand in the way, such as the problem of "jaggies"—irregularities in a picture due to the way points are projected from a simulated three-dimensional scene.

This the Lucasfilm representatives delicately suggested by their T-shirts, which showed staircase-jaggies crossed by a "forbidden" bar.



And so the Lucasfilm folks are both the cutting edge and the living symbols of computer graphics today. Truly, they and all the computer graphic freaks have become—

SMOOTHERS of the LOST ARC

Computer graphics has come from a frontier to a mature industry in just eight years—and is about to flip Hollywood on its ear.

Ted Nelson

It's not Club Med, but for intellectual excitement, for the company of many of the brightest minds of our time, for movies and pictures and special effects, nothing beats the SIGGRAPH, as we lovingly refer to the annual conference of the Special Interest Group on Graphics of the Association for Computing Machinery.

Get there if you can, and before we start, the next one is in Boston, July 26-30, 1982. The admission price for non-students is somewhere around $200, which is damned unfortunate, but utterly worth your while.

Definitely you should be Press if you have any legitimate cause to be, since that's a free ticket. Membership in ACM, that pompous and tiresome society, also reduces the fee somewhat, but since the Siggraph is by far the best thing the ACM does, it may not be worth your while to join.

Computer graphics, the industry, is here and now. Turn on the TV and see computer-generated commercials and show logos. There are production houses on both coasts (like Bob Abel Studios in Hollywood and Digital Effects in New York). Open any technology or science magazine and there are graphics, charts and shaded pictures of seeming 3-D objects, all made by computer.

Ted Nelson, Box 128, Swarthmore, PA 19081.

Photo appears courtesy of Rediffusion Simulation and Evans & Sutherland.

At this last Siggraph the presence everywhere of Lucasfilm representatives—our colleagues, drafted from universities all over—reminded us that computer graphics is on the verge of remaking everyone's dream industry. Lucas's magic studio may not put anything out before 1985, but other heavy-duty film industry stuff is about to begin, in several feature productions already under way.

This will bring new movie realism—but how much? Long ago I proposed a simple Turing test for realism in shaded computer graphics. We will reach the real dividing line, I said, when you can see a synthesized movie of a human being and *not know whether the person is real or synthesized from a data structure*. But when will that time come? There was no way to tell.

The graphics industry has come together so fast. The first Siggraph was in Bowling Green, OH, in 1973. According to one attendee, everyone who came was able to fit at one long dinner table, and the entertainment was Ken Knowlton on the piano.

But the 1974 one, in Boulder, drew hundreds, and the explosive growth had begun. By 1979—Chicago—the ten thousand mark was in sight, and there were something like 50 exhibitors. (The Chicago Siggraph was also special because of the large proportion of female attendees. This may have had something to do with the nearness of Canada, where many of them were from, but it's hard to say.)

Anyway, Siggraphs are among the few computer conferences left where freaks and suitniks rub elbows, and a sense of major community can still be felt.

But "computer graphics" is not just any one thing. It is a variety of techniques that can serve any human activity, making pictures to aid the mind or the emotion. The pictures can be lines, or scenes that look like collections of real objects, even with shadow. Computer graphics can also provide a front end, a visible handle, for all kinds of simulations—metal stress, human population charting, renderings of the architecture of space stations.

And thus, there are very strange bedfellows at the Siggraph. A large number, perhaps a quarter of the attendees (but perhaps far fewer), actually want to make movies—commercially or artistically. Chemistry researchers are another big group, since the molecules they study today simply can't be modelled physically with a bunch of ping-pong balls, as in the old days. Machine designers, especially Detroit and aerospace, are another big category: now they design machines on screens, and call it CAD/CAM.

The space program uses computer graphics: processing and printing the final flyby shots, of course, but also to presimulate the flybys, as well as aid in the visualization of equipment and mission motion. (The one computer graphic freak who has gotten coverage in the lay press is Jim Blinn of JPL, whose marvelous simulation movies of the Jupiter and Saturn flybys have been on prime time TV.)

Then, too, the heavy military and spy organizations are involved, not yet to falsify photographs (though that will come), but to prepare fast-response graphical displays for the Great Shadow Warriors who watch over us, ready to destroy billions of lives in an eyeblink.

> ***"He's one of us," I said to a friend. "Possibly two," was the reply.***

Finally, there are the academic algorithm freaks, always looking for new sets of tricks that will yield better pictures for less crunch. (An interesting hero is Nelson Max, well known for his elegant mathematics films; of whom more anon.)

There is also a good bit of jealousy and tension at Siggraph. Computer graphics freaks, like other moviemakers and chemists, have great jealousies over equipment. There's a great deal of "If only I had...."

Last August Siggraph was in Dallas. For those who attended the sessions, it was four packed days of movie and picture effects and how they were made. For a larger number it was exhibits—lots of equipment and software, much of it in glorious color. But unlike the personal computer conferences, there was little of the stuff offered that individuals could afford. As the old saying goes, "If you have to ask how much it costs, you can't afford it." Very little cost under $20,000, except color terminals.

Sessions and Collisions

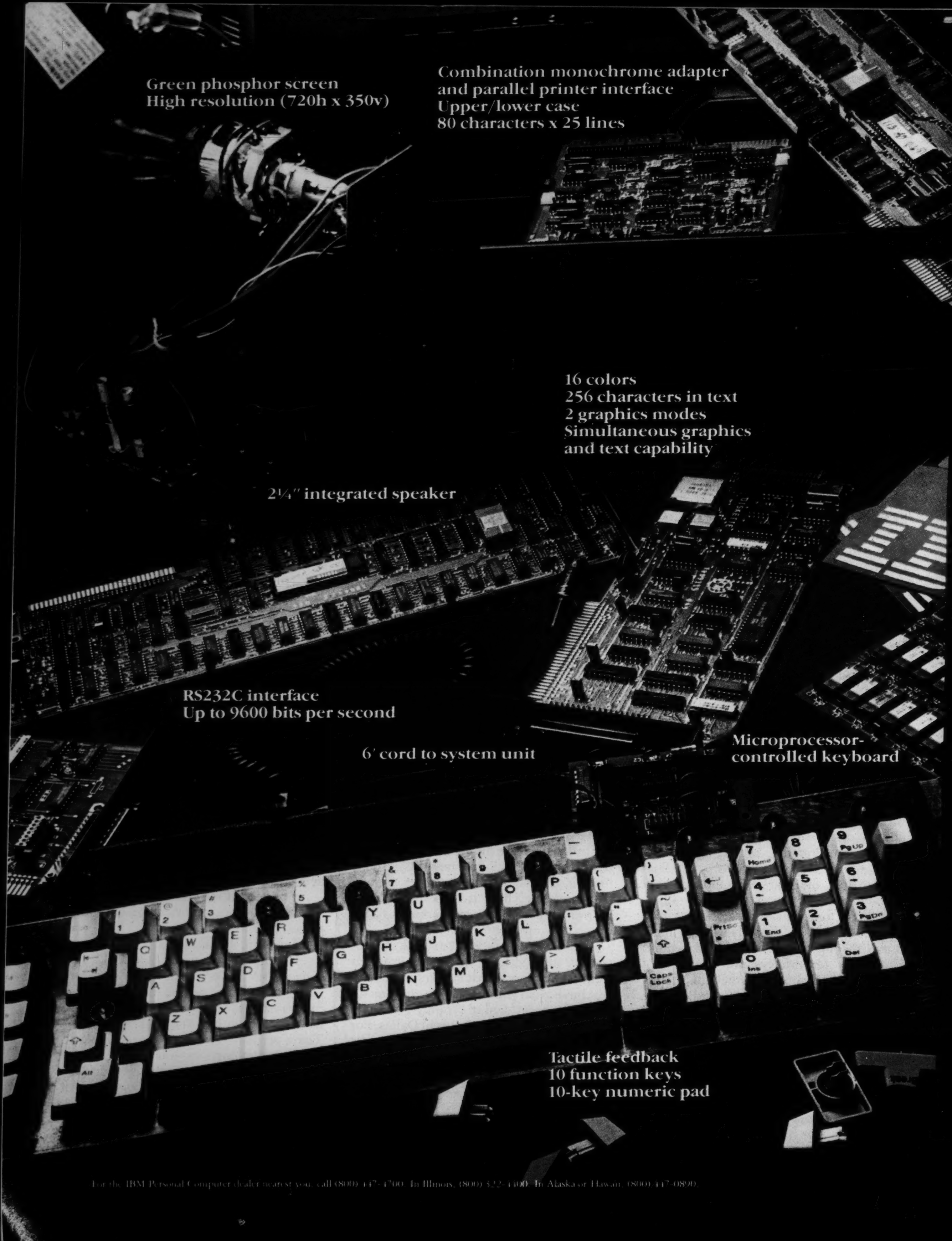
Monday and Tuesday were days of arriving and of plugging in. The exhibits didn't open til Tuesday noon, and these first sessions were called "courses." Enormous rooms ("ballrooms") were set with tables for the many who took the courses (at another $150 or so each). People busily tried to absorb mathematics and watch slides at the same time. As Reporter I darted in and out of various sessions, picking up background stuff. There was plenty of overlap between what was presented in sessions called "animation," "image synthesis," etc.

I talked to superstar Jim Blinn, tall, gaunt and noble with his long blond hair and black beard. He's decided to go back to Jet Propulsion Laboratory from Lucasfilms—the incoming Saturn data told him he wanted to do movies of the rings for the next two years.

As part of Blinn's seminar, we got to hear from an accomplished non-computer person.

David Em, an artist—thin and craggy, glasses pushed back on his head California style—does 3-D art using Blinn's system. "I don't program," he told us; "I work with programmers." As to his work: "There are artists, and people who make pictures." There are also designers, who are told to "make something look good." But an artist has intellectual and emotional concerns. "The doing of it is less important than what you're doing."

Using paint and canvas, an artist can work with perhaps six paintings at a time, hauling them into position and putting them back. But with computer tools, he told us,



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"I generally work with a hundred images at once."

He then showed us a lot of weird, complicated pictures he had made with Blinn's tools: strangely brocaded rooms with arches leading to even stranger places; huge pipes covered with rich colors and patterns reaching through these chambers; kaleidoscopic, arabesque architectures splotched with gold and other colors deep and rich. These highly textured, complicated images were part of "an underground kingdom I've designed that will become a film." A few wispy things he identified as "creatures and creaturettes." Other things he called "fantasy floral studies."

"From the same terminal you can be a painter, sculptor, architect, film-maker...." Frame buffers help: now you can see it all right away.

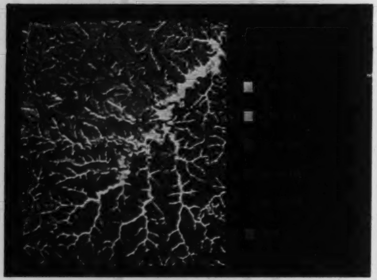
"I use patches a lot," says Em. Also, because there were extensive Saturn-ring programs, "I got to working with rings for a while." He also likes "blobby-molecule" technology, like sculpting clay.

He uttered one sentence to make us all think about the hubris of mankind. "These twists were originally developed for creating galaxies."

There was a time, said Em, that there used to be a "computer graphics look." Now ten artists given these tools would create ten different looks. But artists as a rule can't deal with a high-tech environment—"very institutional"—where you have to go past a guard, you hope there's been no system crash, and it's 30° in the room."

Em said aside to Blinn: "Jim, are you aware that when you have 894 polygons on the screen the bottom falls out?" "Oh yeah, that's because blah blah blah," replied Blinn. (My notes seem to indicate that those were the actual words.)

Under bright lights by the expressway there were disturbingly large bats catching the moths.



LANDSAT Data—Classification processed by DeAnza Systems.

3-D mesh plot of altitude data, Sierra Mountains, by DeAnza Systems.

LANDSAT—Image processed for coal mining application in Kentucky, by DeAnza Systems.

Hallways again. Ran into Tom DeFanti, old pal and former roommate, consummate politician, now the chairman of Siggraph. The meeting would gross a million, he said, and go over 11,000 attendees. We grinned over the discomfiture of ACM.

Herb

Rounding the booths with some friends, I ran into His Greminence Herb Grosch. Feisty, fast-spoken and forthright, Herb Grosch was my hero when I was still new to the computer world, reading my *Datamations* over and over again in 1963. Now sixtyish, he has lost no energy or enthusiasm. "Ted," he said, "you predicted all this, and I didn't believe you."

He actually said that. I have witnesses.

I was floating for a while. "He's one of us," I said to a friend. "Possibly two," was the reply.

The Cocktail Reception

The cocktail party was in a big downtown hotel. We were greeted by the usual clinking roar, and a strange cardboard cutout of an unkind-looking cowboy with a sign bidding us welcome.

The local color was overbearing. There was a foothill-billy band with twirling dancerettes whose skirts went out flat when they twirled. What did this have to do with computer graphics?

I had had dinner and was glad of it. Tables were heaped high with hors d'ouevres; waiters grimly sliced meat for sandwiches as if they were expecting to take home what you didn't eat.

Hors d'ouevres are always a murderous trap, because you can't quite stop shovelling them in but you never feel as though you've *had dinner*, even though you may have ingested three or four dinner equivalents. Worse, for the thirty bucks you've paid you feel obliged to eat it all.

Much milling. The people at one end of the room gradually sat down on the floor and talked about computer graphics and related topics. Others in the room seemed to think there was some other reason to be in Dallas and at this party, and remained standing to behave more like cocktail partygoers. They seemed to disapprove of those who sat, as did some of the waiters. Bearlike Video Bill Etra, he of the beady eyes, menacing grin and immense presence, demonstrated Aikido throws. This caused some people acute distress.

A person with twinkling eyes and a long beard was introduced to me as Ed Emshwiller. Wow! He who made the terrific film "Sunstone" at NYIT! And who was one of my favorite science-fiction artists in the early fifties! Don't remind me of my past," he said. Emshwiller is now dean at Cal Arts, the college Disney founded to grow animators, and is now an independent institution that wants to do neat stuff. With Emshwiller there I'm sure they will.

I also met Bob Berger of Utopia Video, Todd Rundgren's delegate to the conference. It seems that Rundgren, a rock star and hit recording producer, has gone heavily into Apple software as well as video production, and the presence of this well-informed gentleman indicates that *some*body knows what's about to break.

Gradually the food ran out, the bars closed, members of the sitting seminar rose one-by-one to their feet. By and by I walked back to my motel through the hot Texas night. Under bright lights by the expressway there were disturbingly large bats catching the moths.

Wednesday

In perhaps the most dramatic departure from customary methods, a team from Cornell has created an algorithm that works backwards from a picture to infer a 3-D data structure. But the interesting thing is that it isn't heavy AI; it's Watkins-like, with scans and endpoints its main elements. The method is able to scan an existing picture of simplified curvy objects—blocks and cylinders, for example—and reduce them to a classic data structure of 3-D objects. From this, in turn, new pictures can be made from new viewpoints—but the method refrains from guessing what things were behind one another, and so the resulting objects are modestly truncated.

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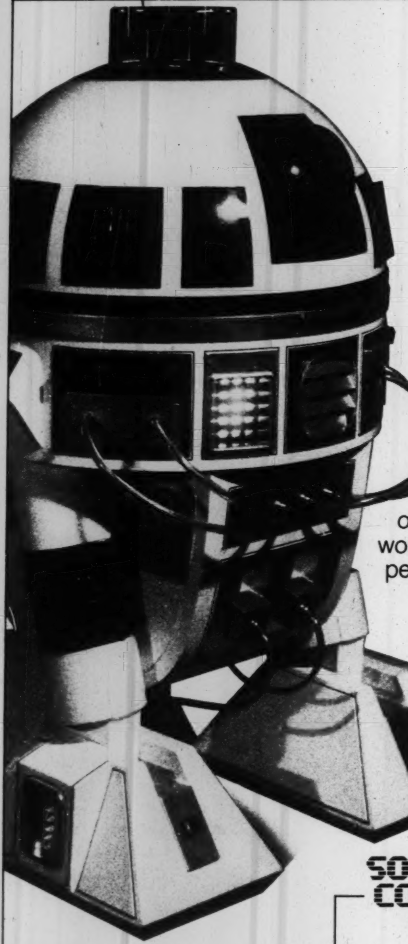

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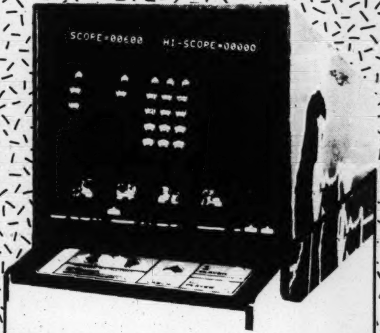

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Apple II (requires paddles)
licensed from Astar International
48K Diskette DOS 3.2 CS-4505 $19.95
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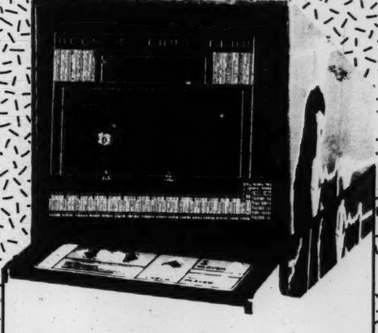
by Matt Hickey

This is the original arcade game, with superb high resolution graphics, high speed action, nail biting tension, and hilarious antics by the moon creatures. Fifty five aliens whiz across the screen, quickening their descent, challenging you to come out from behind your blockades and pick them off with your lasers before they bomb you, destroy your shields, or drop down right on top of you.

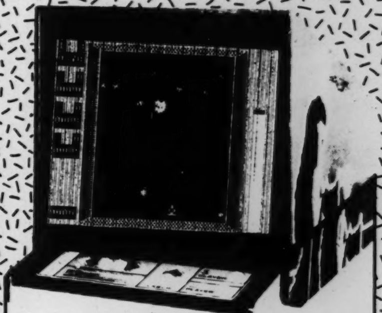
Super Invasion by John Varela
32K TRS-80 Model I Diskette CS-3520 $19.95
16K TRS-80 Cassette CS-3020 $19.95

A low resolution, high speed arcade game similar to our Apple and Sorcerer versions. The aliens move back and forth across the screen, dropping ever lower to attack you as you attempt to destroy them with your lasers.



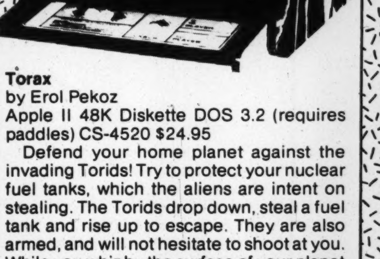
Blisterball and **Mad Bomber**
By Rodney McCauley
Apple II 48K Diskette DOS 3.2 (requires paddles) CS-4511 $24.95

A frantic, fast paced romp that can be played for hours, **Blisterball** is the first truly original arcade-type game for a home computer. As the bouncing balls drop from above, the player moves his laser base and tries to shoot them. It's easy at first—with just one ball. Then come two, then three. It's getting harder. Four balls come, and finally five. Surviving them, the player gets to shoot at inelastic bonus balls. If he makes it this far, the second round starts. The balls bounce lower, the walls close in. Shades of Poe and Newton! Making Superb use of Apple graphics and sound, **Blisterball** can be played by one or two people. **Mad Bomber**, included on the same disk, is another fast paced arcade game. Racks of bombs fill up above you. Whenever four bombs are in any rack, they start to fall. You can shoot them either in the rack or while they are falling, but since there are racks all across the top of the screen, you need to stay ahead of them to survive.



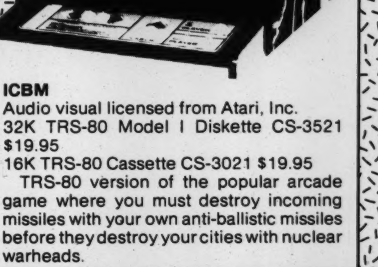
Tsunami
by Rodney McCauley
Apple II 48K Diskette DOS 3.3 (requires paddles) CS-4526 $29.95

Wave after wave of alien attackers attempt to overwhelm your defenses. Each wave comes in a different formation and uses different attack and defense strategies. You get dozens of superior arcade games combined into one program. If you ever master the first set of games on the diskette, where the attackers are without shields, then you are ready for the second set. This time the attackers are sheltered by shields. They can drop bombs right through the shields, but you cannot shoot through them. Successive waves use different strategies. Some move from shield to shield, allowing you to shoot while they are in between. Others just come out briefly to attack, and you must have fast reflexes to get them. Bonus points are awarded for beating the clock, with a countdown timer displayed on screen. This may be our finest arcade game ever!



Torax
by Erol Pekoz
Apple II 48K Diskette DOS 3.2 (requires paddles) CS-4520 $24.95

Defend your home planet against the invading Torids! Try to protect your nuclear fuel tanks, which the aliens are intent on stealing. The Torids drop down, steal a fuel tank and rise up to escape. They are also armed, and will not hesitate to shoot at you. While you whiz by the surface of your planet at incredible speed, you must avoid enemy fire, maneuver your ship, and try to shoot down the Torids without hitting the fuel tanks!



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TRS-80

Sorcerer **Apple II**

> **We flew through the tubes and tunnels and lobes, as if in a tiny airplane.**

Parallel processing sessions discussed new hardware—dense dicussions of dense circuits.

James Clark of Stanford told of the "standard terminal" they are building. It will have a 68000 chip, a big bit-map display, 256K memory, and an Ethernet box. (See "The PERQ," later.) But most originally, it will use about a dozen identical VLSIs which can be pipelined for shaded graphics. They call this the "geometry engine."

Dejaggers

Robert Sproull spoke on how to make lines look straight on bit-mapped screens. You have to add carefully-selected grey squares in just the right places. "Let's not get scared too quickly," he said, and presented a simple lookup scheme for assigning the grey-values with minimal overhead and no need for multiplication. Endpoints had to be handled from another table. (But unfortunately it gets much worse for multiple lines.)

Jim Kajiya, of the University of Utah, looked most unusual with his long black hair and elegant business suit. His Oriental face goes interestingly with his exceptionally beautiful English dictionary voice.

Kajiya is one of the signal guys, showing slides that spatter mathematics all over the place. The idea is to make text characters look right on bit maps. But from a sampling point of view this is difficult. "Text characters have all their energy in the high frequencies." Sproull's gradient model, he claimed, would mess up for graphics in general, but the *correct* method Kajiya suggests is pretty heavy even for text characters. "Unfortunately it would take 3000 hours to compute a 16 x 16 matrix." But his letters looked good.

First Film Night (Science and Technology)*

At Siggraph you go an hour early if you want a good seat for the films; 3500 seats were set up, and all were filled. We were told the hall also held $650,000 worth of projection equipment. By some magical arrangement, union projectionists are set aside and smart-aleck volunteers take over the difficult tasks. The diligence and hard work of this tekkie nucleus are part of what makes the Siggraph such a success. The von Braun of this assemblage seems to be the redoubtable Dan Sandin of the University of Illinois at Chicago Circle, roly-poly and bearded, wearing this night a pith helmet and shorts rather than the Pope's miter he occasionally affects.

Pat Cole, a lovely woman of Lucasfilms, was the person-of-ceremonies; she called up the different filmmakers to comment on what they showed.

First came two astonishing fractal mountian overflights: one was Loren Carpenter's "Vol Libre." It began with the old Teapot. We flew over an incredible, and totally convincing, craggy mountain landscape. A very similar film followed, "Peak," made from only *45 data points*, by Mark Snitily and Rick Speer. One of the fractal mountain films, I forget which, had a bad case of the temporal-jaggy boils—but both were fantastic. (For more on fractals and how they conjure up magic scenery, see the Mandelbrot book in the "Recommended Reading" box.)

Ron Baecker's new Sorting movie was excerpted. This film is a review of sorting algorithms, clarified by beautiful simplified visualizations that show the different sorting processes. (A scattergram of random dots represents unsorted items, a diagonal from lower left to upper right shows a final sorted file. X is current position, Y is actual value in the sort sequence (or vice versa). This makes it easy to see things go to their proper places.

After exploring each method, Baecker presents a race between the sorting methods. Quicksort emerges the clear winner; we see it zippering into the final diagonal in jig time, while Bubble Sort would have taken hours longer than the half-hour film could depict.

Then came the extraordinary brain film. They took leftover human brains that nobody needed any more, and put them on a little sled leading to a fine slicer. A movie camera, locked in place, would take one frame, then a slice would be removed; then another frame, and so on til none was left. This had two results: first, an extraordinary movie, essentially a zoom through a real brain, and second the data structure that resulted when they digitized it.

Then they took the data structure to an Evans and Sutherland vector machine, so the user could—and we the audience did—fly through the tubes and tunnels and lobes, as if in a tiny airplane.

Now came noble Jim Blinn. Satirizing all the talk of how long various movies took to compute, he opened by saying, "The following tape required billions and billions and billions of CPU cycles."

Then came his great flyby simulation films from Jet Propulsion Laboratory. These showed realistic space vehicles—actually

---

*Note: I may have mixed up some of these evening films with films shown at other sessions. Read for flavor.

Smooth Curves

I went to the tutorial section on "sculptured surfaces." It was being conducted by R.A. Barnhill of U. of Utah, bright and jaunty.

As it happens, just as I arrive he has begun to talk about creating smooth curves using triangular patches. (Most surface patches are four-sided.) Triangles have a number of advantages: you can cover surfaces with them, and a given triangle's final curvature can in principle be based simply on the positions of its neighbors.

Barnhill shows movies illustrating the advantages of this method; he definitely prefers designing over triangles to the usual quadrilateral patches.

(Fascinatingly, the triangular smoothing can be generalized into four dimensions, interpolating over tetrahedra, says Barnhill. This might be of interest to Reeves of Lucasfilms (see end of article).

The chairman of the sculpting session, another guy, told us that this session was a "historic occasion," that mathematicians were meeting in this room who had never come together before. "Everybody" was in the room, including a great professor from Germany that he'd never met.

The occasion was historic for me too. Almost ten years ago I filed a patent application based on smoothing curved surfaces over triangles, and unusual and rather humorous special equipment to do it. The expected backing fell through and so the effort was abandoned, at least in that form.

Still, I managed to burn out a couple of mathematicians trying to work out the curvature method in its full generality, which we never did. Now here it was, encountered as it were by accident, all worked out by Barnhill and his colleagues. At least I felt ruefully justified by the difficulties they had encountered, in that the problem had been mathematically quite serious.

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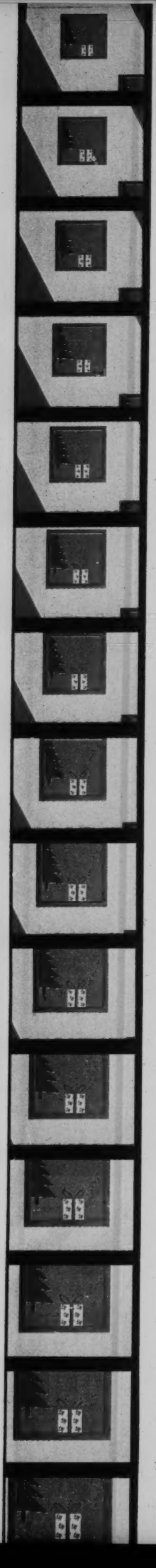


Siggraph, continued...

a bit cardboardy—crossing starfields and gliding around planets. The Saturn Flyby pre-movie, made before Voyager actually got there, quite accurately foreshowed the views of Saturn that actually came back. (Blinn interjected that he uses Quicksort, a mundane arranger for his celestial objects.)

Blinn also showed the DNA sequence he had made for the Sagan "Cosmos" series. It's up for an Emmy in the category of "videotape editing." No, a lot of people do not understand what's going on.

Now Nelson Max showed a film illustrating the close-in molecular effects between DNA and some chemical. "Everyone knows that atoms, when viewed close enough, look like shiny plastic balls," he said. He then proved it with his film. "It's just physical attraction at this point," said Max archly as various molecular structures slid into one another.

> ***Awakening on the balcony the next morning, I looked down and saw* ice skaters, *so help me.***

After seeing some other film "I got jealous," said Max, in his dry and delicate manner, "so I made this one." He then showed "Carla's Island," a scenic fantasy. The camera stares at a couple of cupcake islands surrounded by waves. The camera does not move, but waves, clouds and sunset do. And they are amazing, as are the reflections and ripples. Like much of Max's work, it's a double whammy: a remarkable wave simulation done by extraordinary means in a pipeline-compiled program for the Cray-1. (See end of article.)

In contrast with the computational efficiency Max had contrived, Turner Whitted of Bell Labs showed a short film with remarkable properties, made in the least efficient way. Whitted is concerned with exactness of optical simulation and so uses ray-tracing in an elaborate tree-structured model. His film showing a ball swinging around a glass sphere, lasted only a few seconds on the screen, but took days of CPU crunch to compute.

Now came the film from Evans and Sutherland, made on the CT5, the new aviation and scene simulator. YOW! First we are driving down a highway (complete with oil smudge). Now we are shooting down helicopters. Now flying behind another airplane, its red tailburn hot upon us. Now we are flying above a desert in twilight fog, with telephone poles and cacti! *Incredible*!

The evening's surprise entertainment was a marvelous little film that combined chemistry, beautiful patterns and group-theoretical geometry.

It was called "Tomato Bushy Stump Virus," but the Scott Joplin piano was a tipoff. The virus, a "solved" virus, was a ball of different-colored threads of atoms, that bowed to us this way and that, showing off its symmetries.

After the evening of science films, there developed the usual collegiate game of Who-Knows-Where-the-Party-Is? where groups of people try to go off somewhere while getting rid of nearby people they don't want. I ended up at the party of Digital Effects, hosted by its president, Judson Rosebush. Rosebush, thirtyish and grave with long sideburns, has spun from out of nothing a functioning computer movie studio in the killer atmosphere of New York. They now use both a Paint system and a turnkey 3-D image synthesis system—all programmed in C.

At the party I talked to Aaron Marcus of Meta-Graphics, Berkeley—a tall and thoughtful graphic artist who is bringing a complex philosophy of art to graphic screen design. A most unusual individual, he wears a yarmulkah with Mickey Mouse ears and no loss of dignity.

I chatted also with one Guy Nouri (pronounced "ghee newry"), an imposing young man reminiscent of the young Orson Welles, who is editing a new mag with the imposing title of *Electronic Publishing and Computer Graphics*. It was getting very late, but I thought I heard him say the magazine would be on-line.

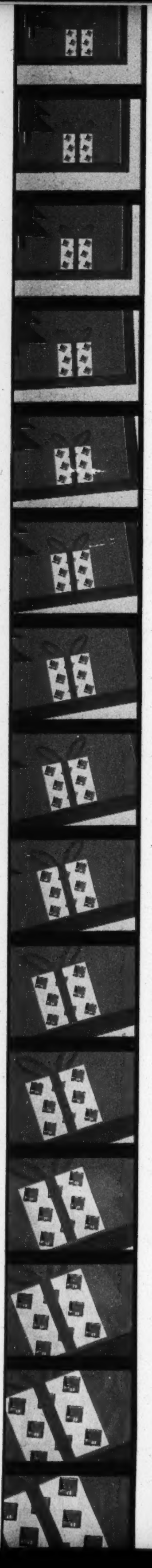
The party was high up in something called the Plaza of the Americas, which turned out to be a huge glassed-up edifice with an enormous interior space. We peered down from a balcony onto sidewalk cafes, pedestrian malls, shops. The party was populated by New Yorkers, smoking, drinking and jabbering, and I played where-did-you-go-to-high-school with attractive women. The cynicism and fast talk made me feel finally at home, and I gradually went under.

Awakening on the balcony the next morning, I looked down and saw *ice skaters*, so help me. Texas obviously will surprise you.

Thursday

Richard Bolt, of Bolt, Beranek and Newman—not Richard Bolt the BBN *founder*, but a different Richard Bolt who works there—showed us his Dataland. (See "Interactive Systems and the Design of Virtuality," *Creative Computing*, November and December 1980.)

The user (we see in the videotape sly Nicholas Negroponte of MIT being the



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But don't take our word for it, *Wizardry* received reviews in the May issue of *Creative Computing*, the April issue of *Popular Mechanics*, page 38, and the August issue of *Softalk* magazine.

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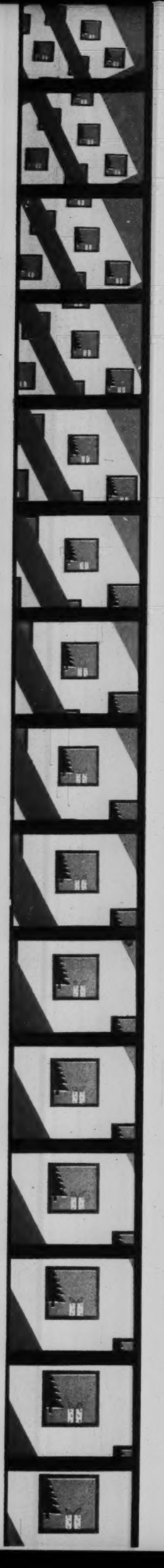

Siggraph, continued...

user—Deus *in* machina) sits on a throne before a big screen, on which many little pictures are seen. Each picture is a symbol or shrunken view. Whatever picture the user chooses expands to show more.

This World of Windows (a nice acronym) is a brilliant, clear way of looking into a data base management system. It requires hardly any learning whatever—especially in the manifestation Bolt shows us now, where the user's *turning eyes* call up one thing after another. This is called gaze-orchestration. (You, of course, need very special glasses, specially adjusted.)

Other Human Hookups

Ron Baecker chaired a panel on interactive interfaces. His opening speech stressed some of the common funny words: "English-like," "adaptable," "natural."

Fred Brooks was the first panelist: diminutive but domineering, a forceful Southerner.

Brooks was Project Director for the development of the IBM 360 computer, and must feel a certain ambivalence about its reception in the world. IBM has ridden the 360 to great lengths and great profit, but many computer people consider it one of history's atrocities. (Brooks has written what could be taken as a sort of apologia, a good book on project management called *The Mythical Man-Month*.)

At the University of North Carolina he and his group have created a facility for three-dimensional chemical and crystallographic modelling, intended as a master facility for use by scientists from everywhere. Thus they have had to build a system that could be learned quickly by a visitor with tightly-budgeted time who is staying at a boardinghouse. Minimum button-pushing, controls orthogonal to one another are critical, he says.

Siggraph and ACM

ACM has already been left behind by one of the two most important movements in computerdom, personal computing, and it keeps a slim, fingernail hold on computer graphics only by its sponsorship of the Siggraph conference. But Siggraph is getting to be bigger than ACM in more and more ways—the conference grossed a million dollars this year, and it has outdrawn the annual ACM conference by a wide margin for several years.

In short, ACM trying to keep Siggraph is like Caspar Milquetoast holding a lion on a leash. Some, like this author, feel that ACM has been the voice simply of pompous, stuffy and elite professionalism for too long, and that Siggraph should break away.

However, Siggraph's head, consummate maneuverer Tom DeFanti, will undoubtedly use this growing leverage to win more favors from ACM. Perhaps we can also hope for a "baby Siggraph," with low admissions but the same sorts of movies, for personal computer enthusiasts.

Evidently their system works so well it only requires close instruction for the first hour, then a counsellor nearby for the next eight, and counselling "available" for the first few nights on the system.

Interestingly, Brooks asserted that control bandwidth must be high: he says the controls have to be polled at least *fifteen times a second.*

Bill Newman (of Newman and Sproull)—a crisp Englishman—talked about the evolution of experimental text and office systems at Xerox PARC. The "Office Talk" language evolved, with a control structure that used shrunken fields at the bottom of the screen that could be rapidly expanded. He pointed out a classical tradeoff: the quality of the interface versus ease of implementing it. Newman also seemed to claim, interestingly, that idiosyncratic styles of use can't be allowed, but I didn't get a chance to question him further on that.

William Buxton, Toronto musician, showed his coordinated sound-synthesizer project. He has many controls for, and many visualizations of, the sounds his synthesizer puts out. His CONDUCT program uses an ASCII terminal and tablet, which control an ongoing performance. On the screen he has a "piano-roll" notation, virtual keyboard, virtual sliders, virtual knobs. A waveform editor allows sounds to be carved and combined.

Harmonics can be viewed in 3-D, as cardboard cutout mountains. (The present instant in time goes diagonally down and to the right on the screen, a strange effect.) Amplitudes jut like cardboard mountains from the parallel lines of his notations, yet are understandable. (He confused us somewhat by referring to the "zed axis," a curious Canadian way of referring to the last letter of the alphabet.) Anyway, he can rotate the Z-axis—however you say it—on his display of cardboard Alps, for whatever visualization he prefers. They look interestingly different.

In the question period, I attempted a brief sermon on the Virtuality* approach to interface design—viz., that there should *be* no interfaces, but rather carefully-designed comprehensible *worlds*—but Baecker cut me off. He doesn't get it.

Lucitron's Flat Panel

I managed to catch the afternoon presentation by Lucitron of Northbrook, IL. Lucitron is really Alan Sobel and Joe Markin and their colleagues. I've known Alan and Joe since my first SID convention in 1965.

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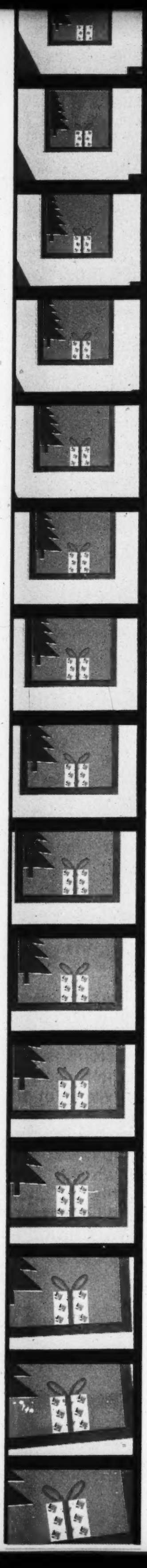
*Again: T. Nelson, "Interactive Systems and the Design of Virtuality," *Creative Computing*, November and December 1980.



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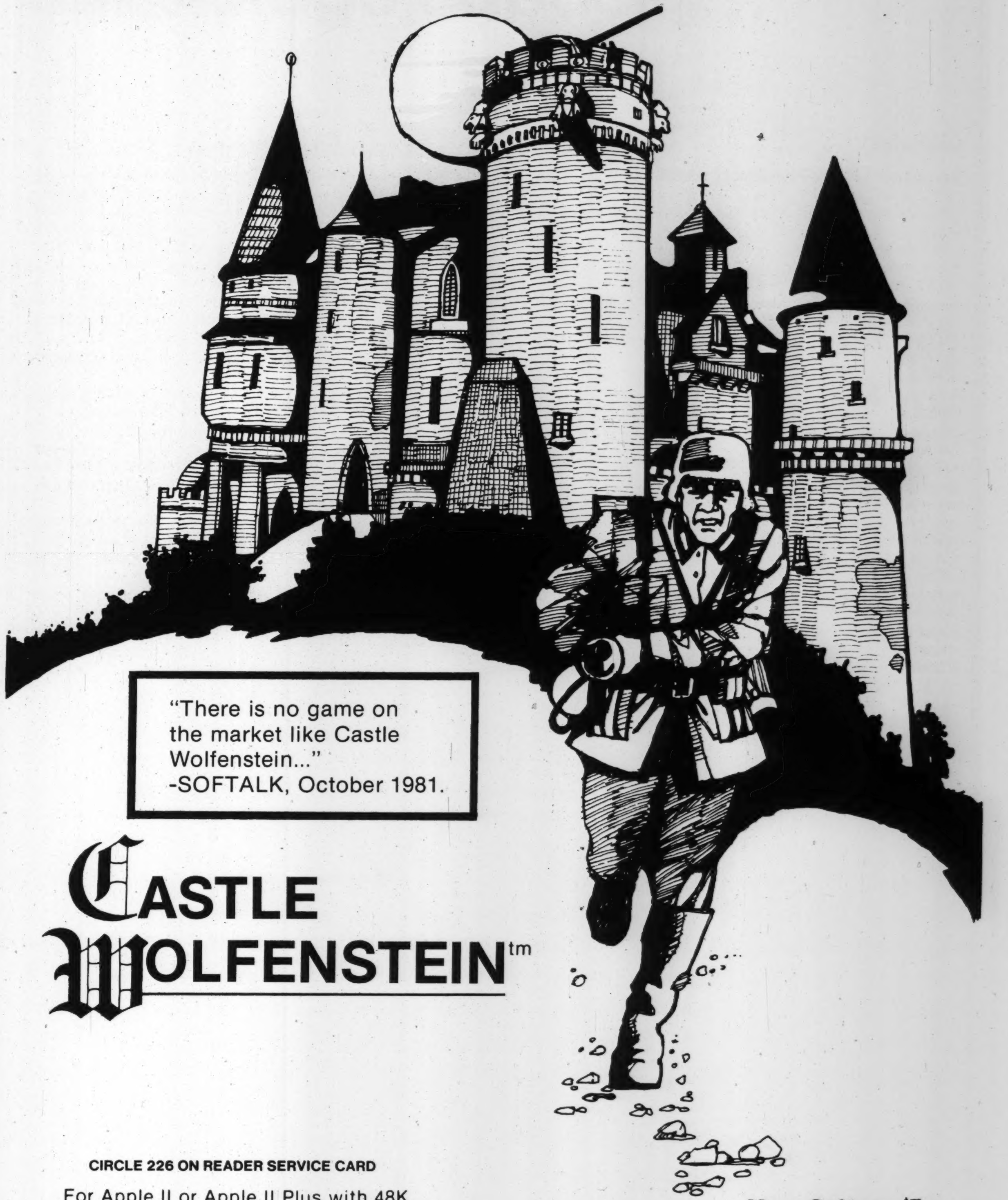

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-SOFTALK, October 1981.

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Glossary

2-D system: A computer graphic system whose data represents only a plane.
2 1/2-D system: A computer graphic system whose objects are flat, parallel surfaces that can cover each other.
3-D system: A computer graphic system whose data objects are in three dimensions.
ACM: The Association for Computing Machinery, the Official Society of All Computerdom.
Anti-aliasing: Dejagging.
Aliasing: The mistaking of some object or situation for another, especially because of the way data is examined. Examples: movies of propellors and wagon wheels that seem to turn backward; musical notes that are wrongly analyzed by sequential measurement (for instance, thought to be an octave too low); and, especially, *jaggies*.
Bit map: Picture made of little dots or squares; circuitry needed for it.
Bit plane: The circuitry required to make a bit map display; especially when combinable or "stackable" to allow more than one bit per pixel. Thus two bit planes give each pixel four possible colors to select from, five planes yield 32.
CAD/CAM (pronounced *cad-cam*): A design of physical objects, to be actually manufactured, on computer screens. Idiotic term is acronym for Computer-Assisted Design/Computer-Assisted Manufacture.
Calcomp: The maker of pen-plotters hooked to computers to draw lines on paper; generically, such a machine.
Classical computer graphics: 2-D line drawing, 3-D line drawing, or 3-D shaded graphics with each facet having exactly one shade or color.
"Computer graphics": Any method of making pictures by computer.
Gouraud shading: The apparent curvature of an object actually composed of polygons, based on averaging brightness. Can be merged with Watkins method.
Dejagging: Avoiding or getting rid of jaggies. Increasingly this is done with pixels of intermediate shades, carefully placed along the otherwise-jagged object, making it look smoother.
Frame buffer: Hardware to hold a bit-map picture, especially when hooked up to a computer so that a user may add effects one by one and see the result.
Halftone: Shaded.
Hidden-line: 1. Referring to lines explicitly removed from a line-drawing system. 2. Sloppy term for *shaded-surface*.
Hidden-surface: Shaded-3-D, emphasizing the fact that you're not seeing some of the stuff.
Image synthesis: 3-D shaded graphics.
Interpolation: Smoothing of a set of data points by providing intermediate values somehow.
Jaggies: Irregular edges on something that should look smooth, a byproduct of the method of searching a scene and of too coarse a bit map.
Paint system: Computer system allowing a user to "paint" a two-dimensional picture, using a tablet or lightpen, a frame buffer, and elaborate programs.
Palette box: A hardware arrangement that lets you select a certain set of colors or shades of gray from an enormous number of possible ones, then use these colors on a screen by selecting from them with only a few bits per pixel. For instance, if you have four bits per pixel—two bit planes—you could have a palette box selecting from a palette of four different colors at once. (The Atari 400 and 800 are perhaps the only mass market computers offering a palette box at this time.)
Patch: A data structure in 3-space representing part of a curved object. Main types: Coons, Bezier.
Phong shading: Shading based on angles of rays reflected from a virtual object in 3-space.
Pixel (called by the phone company *pel*): A picture cell; dot or square in a bit-map picture.
Polygon: A closed figure with straight edges; often used as the underlying 3-D data structure for shaded-3-D systems.
Polyhedron: A 3-D object made of polygons.
Raytrace: The simulation of the path in 3-space between the viewer's eye and an object, possibly extended to take into account reflection or light. Easy to program, horrendously slow.
Sampling: Taking parts of any data object. Sampling theory gets very technical, and considers any object whatever (you included) as a mixture of *frequencies*—a startling view to laymen. Closely related to signal theory, information theory.
Scene simulation: The simulation of a three-dimensional scene for computer display.
Shaded-3-D system: A computer system depicting a three-dimensional scene in a photograph-like picture.
SID: Society for Information Display, a group that preceded Siggraph but stagnated.
SIG: Special Interest Group of the ACM—a political method by which ACM co-opts runaway parts of the field.
Simulation: Any imitation, by a computer, of anything.
Specular reflection: A glint, sheen or mirrorlike reflection.
Surface: Part of a 3-D object.
Surface system: A shaded-surface system.
Teapot: A famous object humorously put into many shaded 3-D pictures by various researchers.
Texture mapping: The process of assigning a previous picture to a 3-D surface, making the old picture look like a surface texture.
Vector: 1. Row of numbers. 2. Line on a screen.
Vector processor: 1. Computer that operates efficiently on rows of numbers (such as the mighty Cray-1). 2. Device for showing lines on a screen.
Virtual object: Something simulated for depiction in a three-dimensional space.
Voxel: "Volume element" on Genisco SpaceGraph (by analogy with *pixel*).
Watkins method: A nearly-standard method for shaded-3-D using lists of edges and certain methods for stepping and counting among them.
Z-buffer: A frame buffer with bit planes holding a distance-number for each pixel, as well as a color value; thus permitting each new surface added by the user to be judged, point by point, as to whether it is in front of the surface point already stored there—in which case it replaces it.

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Saturn Image by Dr. James F. Blinn, as generated on the AED 512 Graphics Terminal.

This time folks were most rowdy, like a "Rocky Horror" audience.

They're still together, a kind of a reverse Laurel-and-Hardy team—except Clever and Warm instead of Dumb and Grouchy. For years they and their group were the R-and-D arm of Zenith TV in Chicago, until Zenith dropped the whole Chicago division. At which point Sobel and Markin and their team cannily slid off into their own company.

They showed an 8mm film of their flat-panel display system. Not quite technically a CRT, it has a phosphor responding to gas-cell emissions in an array of cells behind it. You could tell from the film that the system was real, and does, indeed, look and perform like flat TV. It's still under development, and they say it should be another year, but they obviously know what they're doing, and they are prepared to take their time. There have been other widely-announced flat-panel TVs, but ask them about the others. They don't knock anyone else, but their message is clear: "We're the real one." I believe it.

Jaggies, Alias Aliasing

There are two ways of thinking about jaggies. The *scene-analytic* school sees them as a result of the way you are chugging through the scene to make a picture. The *signal-theory* people see it as a special case of esoteric mathematical frequency analysis. Both are correct.

The afternoon closed with a wine-and-cheese party in a cavernous hall. Aside from a few kiosks at which you could get cheese, you could also file across the stage to get cheese, and hundreds stood in line to do so. A bizarre arrangement.

Second Film Night (Art and Entertainment)

This time folks were most rowdy, like a "Rocky Horror" audience. Tom DeFanti took the podium in a flickering hard-hat dotted with LEDs. "Is it anti-aliasing?" yelled somebody. "It's real time," said DeFanti.

A European commercial spot showed that they have hidden-surface shading over there, too.

A Stan Vanderbeek short, called "Curious Phenomena," had nice visual puns in it.

DeFanti: "Our goal is to mix heavy duty computer graphics with video weirdness, because I really think you guys should get together." So we got some surrealist video. Palpitating blobs and giggling hippies making silly remarks, the Chicago wacky school. Then an Etra piece, Digital Video Wallpaper.

New York Institute of Technology showed a short clip—a few seconds—of a credible woman swimming. (Apparently polygons with Gouraud shading.) A remarkable achievement.

Then, also from NYIT, Bonnie Williams's "17 symmetries" program. Then footage of deer loping through a forest, seemingly by conventional animation—it could've been from "Bambi." Then the first flim clip from their under-wraps film, *The Works*—a Roving Chromium Ant Robot. Great cheers. There was some hissing at Exxon commercials, but then loud cheers for the closing NYIT logo.

More surrealistic video stuff (by Vasulka).

Larry Cuba, "Two Space," closely reminiscent of John Whitney: Javanese music, symmetrical little thingies moving all over; particles appear, then annihilate each other, all to music.

A sparkling exception to the meaninglessness of the video presentations was Copper Gilroth's delightful tape, "Skippy Peanut Butter Jars." Unlike most of the Chicago video, this had *meaning* and *content*. It was a simple anecdote: Gilroth, when young, wanted to be an artist, and believed that artists drew nude women. She practiced drawing nude women, but, apprehensive of discovery, buried the drawings in Skippy Peanut Butter jars. On the tape, her computer drawings illustrating this touching anecdote are multipled as we hear her voice overlaid time and again on the soundtrack, telling the same story.

Bob Abel Studios, of Hollywood, showed a film of a whole wire-frame model of downtown Chicago. We fly over the city, look down on a wire-frame Sears Tower. Dizzying! Great applause. Abel Studios also showed one of their wild Levis commercials. An audience favorite was their paper-airplane sequence, where a paper airplane darted around a room full of wire-frame furniture—then out the window and over and among the wire-frame Chicago. (Credit went to art director Randy Roberts.)

A big piece by Sandin, DeFanti et al. involved their usual palpitating blobs and spirals. Then came a peculiar videotape called something like "The B52s Return to Planet Claire," with various shots of two attractive young women, sometimes nude, posing variously to rock music.

But finally came the Triple I presentation to close the show: "the film that nobody wanted to be after."

We see a man juggling geometric shapes. He wears a top hat and tails, and stands on a checkerboard floor.

Wait a minute. Is he real?

No. He is a simulated man. *This is the first time I wasn't sure right away.* That was the Turing test. I couldn't tell the difference. *The time has come.*

Now the juggler again, in a storm of geometric shapes. Finally he takes off his hat, jumps, and disappears into it.

Great applause for Triple I.

More On The Graphical Turing Test

The graphical Turing test is interesting, but on being thought over gets complicated. The 3-D scene of the juggler was fully synthesized—but from a data structure they had measured off a real person, a juggler/gymnast named Ken Rosenthal.

Stop the Floppy Shuffle

PAYROLL I
initialized
1-18-81

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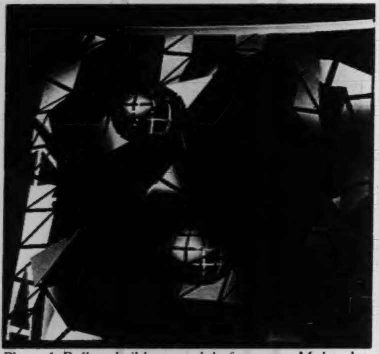

Photo 1. Ball-and-ribbon model of enzyme. Molecular data courtesy of D. and J. Richardson, Duke University. Computer graphics by Michael Pique, University of North Carolina using Brigham Young University's "MOVIE.BYU" software package.

Photo 2. Surfaces: L. Nackman, University of North Carolina with MOVIE.BYU.

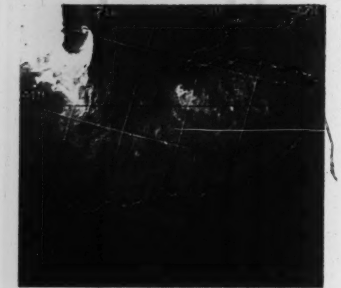

Photo 3. Cape Cod: O. Brown and R. Evans, Dept. of Meteorology and Physical Oceanography, RSMAS, University of Miami.

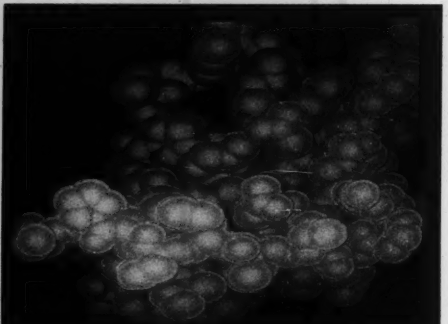

Photo 4. Molecule: M. Pique, University of North Carolina, sphere plot, B. Low, Columbia University, co-ordinates.

But now that we're digitizing real people, what's the distinction between that and some kind of photograph? Is it the level of granularity? The number of processing stages to remove? (I never quite expected how many intermediate and in-between and ambiguous layers there might be.)

Epilog: A Poll About Art Video

Personally, I have never been able to stand surrealistic video. I took an informal poll after the show and was surprised to find that most people didn't mind it, even Herb Grosch. Of the ten people who didn't like it, all but one were New Yorkers. The non-New Yorker said: "It really insults the Triple I and Saturn stuff to have the video home movies." But apparently most attendees didn't mind.

While everybody else was waiting for cars, I had a chance to walk across Dallas with none other than Scott Kim.

Kim is unusually famous for a graduate student—he's in AI or the like at Stanford—because of his incredible agility with reversing calligraphic puns, as will be seen in his book *Inversions*. He is also—he had to be—an extremely witty and sensitive, if not telepathic, individual. The other guy walking with us, whose card I seem to have lost, turned out to be the head of the Forth User's Group (demurely called FIG). Forth is the only decent language for small computers, but that's another story.

There was partying afoot, but soon I realized I was too tired. I started walking home, but, tired or not, there was one thing I still had to see in Dallas. As I said before, downtown Dallas is small, and it took only a few minutes of guesswork to find Dealey Plaza.

Siggraph Quotes

"Why didn't they serve popcorn at the Siggraph movies? Because nobody implemented the kernel."—Stuart Greene

"Why can't computer people tell Hallowe'en from Christmas? Because OCT 31 = DEC 25."—Jim Heller

"Once you tell management what you're doing, you're finished. They don't care what you're doing, they just want to hear that you're ahead of schedule.—Anonymous

"It would take a computer the size of a Cray-1 to model a housefly."—Gary Demos

"There's a need for all kinds of graphics. Detroit wants a smooth hood, Schlumberger (the oil explorers) wants a fault line."—from the surface sculpting session.

"If you have to ask what it costs, you can't afford it."—Old adage, oft-repeated.

"Well, you can always do ray-tracing."—A general sarcastic remark, frequently heard.

Nobody was there after midnight, just an occasional car passing through. But Dealey Plaza wasn't really there either. The contours that assassination buffs knew and loved appear to have been carefully paved and rearranged with new monuments. There is no more Grassy Knoll, no more evidence. A Congressional Committee recently decided that this was the scene of a conspiratorial regicide, but it's been paved over in more ways than one.

Hypertext Repair Manuals

I stumbled out of bed on the morning of Friday the seventh to hear a dawn presentation from Brown University on "computer-based documents."

What they described was a documentation system to hold on-line repair manuals for complex equipment (a task evidently dictated by the source of funding, but providing some good opportunities for generalized development). The whole computer, graphic display and database are all intended to go, by and by, into a repairman's ruggedized suitcase.

The screen holds both text and illustrations; the pictures of equipment are nice colored pictures in a frame buffer, projected from three-dimensional data structures onto bit-map displays.

Their hypertexts are built of "pages" nested into "chapters," which are in turn hierarchical. Strictly tree-structured, as far as I could tell, and linked to a DBMS which keeps track of the chapter pieces, graphical hierarchy, etc. The controls, too, are color pictures. Links, timeline and BACK are buttons. A "session timeline" is a nice touch, allowing the repairperson to go back to something he did earlier by pointing to the historical trace. Whether this could itself be recursive—going back to going back, etc.—was not touched upon. "We try to make document creation like creating graphics," said the speaker, a remark that becomes increasingly puzzling the more you think about it.

I galloped over to a standards meeting. It was intense, and had attracted hundreds of the sort of people who would get up on the fourth morning of a Siggraph convention to attend a standards meeting.

This group was, according to the program, concerned with the standardization of a "Metafile" which would apparently become some sort of computer graphics interface. I figured I had better find out about it, whatever it was.

Well, they are working on the standard called ANSI X 3H3. They talked about standardizing a VDI, Virtual Device Interface, which would be a piece of software acting as a cushion between device-dependent stuff—your own weird display and keypads and joymice—and device-independent stuff.

Aha. Sounded good. Here we were really going to get to something. A universal, device-independent kind of interior structure that would be the very essence of

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Raster Technologies offers a powerful frame buffer with as many gradations as anybody could want.

generalized computer graphic data. ZOW.

The Metafile was to be a mechanism for retaining and/or transporting graphic data and control information. Supposedly this would yield a picture transfer and storage standard independent of both devices and installations. It would have "required" functions and "nonrequired" functions, leading to a "minimum metafile" and an "extended metafile." The virtual device interface will supposedly handle query and response, support multiple device drivers, allow distributed functions, provide for extensions and escapes, and have low overhead.

But this stuff went on and on and seemed progressively murkier. I stood up and asked very politely what the hell they were talking about. What is computer graphics but all kinds of different windows looking at four things—bit-map pictures, 2-D line pictures, 3-D line pictures, and 3-D surface structures (like the Great Teapot)? And we are going to have to make links to, and annotate, these objects and structures. Wasn't that what they were describing?

> ***I noticed people all over the audience feeling their faces and contorting them in weird expressions as he talked.***

No, chided the chair. They were concerned really with things like vector graphics and pie charts.

Oops. This was a group set up to standardize a *virtual Calcomp*. (With extensions for interaction and animation.) They think they're dealing with contained *pictures*, not larger bit-map tapestries or representations of physical *objects*.

No wonder those people had looked so intense. Among all the 3-D whizbang movie stuff, they had felt lonely, and missed the clacking of the pens. The moving storm of computer progress leaves many stagnant puddles. Like all stagnant puddles, they teem with interesting life.

Back to the main sessions. An interesting paper on how the National Command Authorities—the Master Bombers you don't want to think about—handle maps for "austere" graphics as required for fast response in dire military "scenarios." Basically they simplify the map outlines.

To quote the proceedings, they have to keep these data maps compactly stockpiled in "deployable command centers that are capable of enduring through nuclear as well as conventional warfare." For this most austere system, it was found that they could simplify map outlines considerably; "... there are particular geographic regions which are cluttered with small islands. Since these islands have little or no significance in the command and control environment, a method was needed to remove them from the data base...." (From the Proceedings.)

That's a good hint about where to move to. If you're not in the data base, maybe you can survive a good command and control orgy; they can't see you to nuke you.

An E&S presentation showed how they swap an infinite number of polygons in and out of their simulators, making possible round-the-world missions—bombing runs or civilian pilot training—all smoothed with the latest interpolation formulas. And they showed more of their glorious dogfight and landing films.

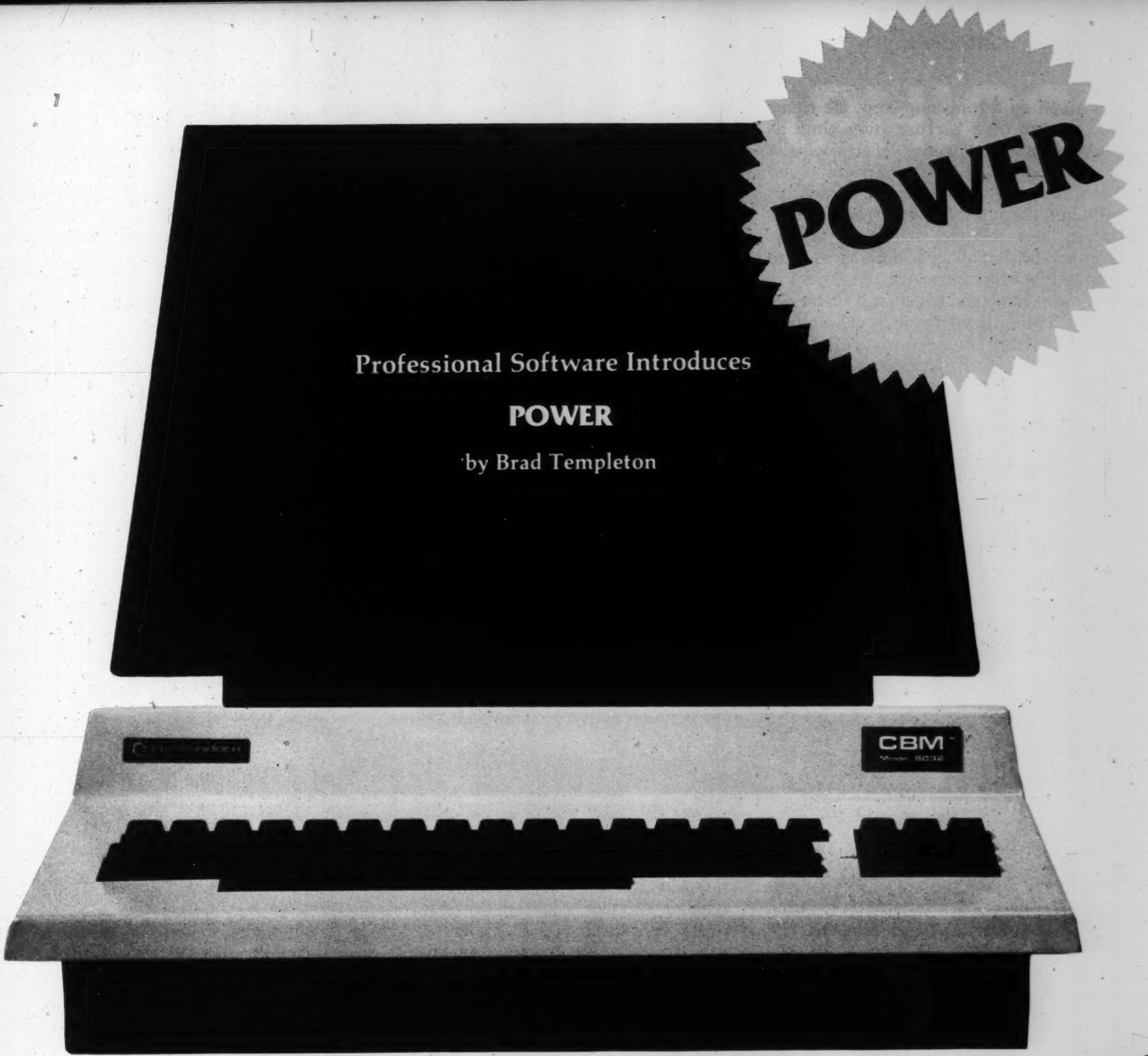
The Animation Session

Away the sinister stuff. Now the animation. Steve Platt, of the University of Pennsylvania, talked about problems of animating faces. The multidisciplinary project he is on is studying sign language, the physiology of expression, the way face-flesh slides across bone. (I noticed people all over the audience feeling their faces and contorting them in weird expressions as he talked.) While encoding the surface structure is relatively straightforward, the deep structure is hard.

Next we heard from Bruce Wallace of Cornell—and Hanna-Barbera. Pointedly illustrating with drawings and overlays of Fred Flintstone, Wallace showed us how they can now handle cleanly the input scan of paper artwork and its low-cost superimposition into composite cartoons. (This is especially important for the limited animation that has been the Hanna-Barbera trademark since they left their quality Tom-and-Jerry animation at MGM to go grind out the Flintstone stuff for television.) The anti-aliasing Wallace uses at the picture edges is not unlike the same techniques we heard about from Sproull and Kajiya, but extended to bit-map masking. To speed processes, he deals as much as possible with enclosed subpictures, using run-length encoding and taking advantage, where possible, of frame-to-frame continuities.

Then came the Lucasfilm presentation everyone was panting for, by Bill Reeves of the University of Toronto—and Lucasfilms. It wasn't what anybody expected: no rocketships, no adventure. He threw us a curve.

In classical animation, they began with certain drawings—the key frames—and then drew the in-betweens. When computer animation started, first they tried the same thing. Then came Ron Baecker's animation, where he moved shapes along a preset moving line (the p-line). Reeves, however,



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has taken an astonishing step. He treats the change of a picture over time as essentially a *three-dimensional interpolation problem*—time is a dimension, right?—and Lo!—interpolation between 2-D pictures over time, through *3-D* Coons-patches, turns out to have the nicest motion quality. Original, important, and coming soon to your neighborhood theater.

A wave-simulation paper from Carnegie-Mellon demonstrated that a generalized scene-simulator, getting down to the details of *fine light waves*, could generate complete optics simulations—the scene, the camera, and the pictures the camera would take. They actually *simulate a camera*, physically in 3-space, with all the light rays and including both what's in and out of focus. And yes (in an answer to the audience), it can do holograms.

Cook and Torrance, listed in the Proceedings as being at Cornell (but now at Lucasfilms), gave us an analysis of reflective coloration. Their mathematical model almost perfectly simulates with a few numbers the glints and highlights of copper, stainless steel, rust, rubber—anyway, reducing any substance to a simplified set of reflectance parameters. ("For any set of numbers you can probably find some substance," says Blinn archly.)

Fantasy Island

As the conference finale, Nelson Max got up to discuss his Island film (from the second night). (The conference planners deliberately put it at the end to induce everybody to stay.) Max is a heavy-hitter, a mean mathematician devoted to making pretty pictures and complex ones—pretty complex pictures indeed—like his movie of the topological inversion of a sphere.

In dusty, acerbic tones, Max told us how he had reduced the enormous complexity of his wave-island-cloud scene to simple analytic polynomial structures, nonrecursive, to avoid random disoptimizations on the Cray. There were no fractals, he stressed; his beautiful clouds looked like fractals, but they were done by polynomials. His polynomial clouds had various cosine terms and adjustments to curve them properly.

Recommended Reading

W.M. Newman and R.F. Sproull, *Principles of Interactive Computer Graphics.* (Second Edition 1979.) McGraw-Hill.

Theodor H. Nelson, *Computer Lib.* Published by the author. $10 plus $2 postage from The Distributors, 702 S. Michigan, South Bend, IN 46618.

Siggraph 81 Conference Proceedings. ACM Order No. 428810 from the Association for Computing Machinery, 1133 Avenue of the Americas, New York, NY 10036. ($30; $21 for members.)

Benoit B. Mandelbrot, *Fractals: Form, Chance and Dimension.* W.H. Freeman & Co., San Francisco.

He optimized everything in the program to shoot through the Cray-1 computer—a superfast numerical vector machine—exceptionlessly and at high speed. That meant no wild reflections, and every pixel reduced to a clean raytracing sequence.

Each island had three sections: a lumpy polynomial top, simple sides, and an easy beach. More important, each point on the island had at most two reflections. The intricate, realistic waves were lists of coefficients of cosines in a Fourier series. "It just involves the square root of the discriminant to determine the piercing-point," Max explained with some satisfaction. And the sun was added in the output minicomputer. (How it went behind the clouds is obscure; but the output minicomputer was an Eclipse, so that might have helped.)

The Zibbits

The Siggraph exhibits were many and marvelous. Here are the things I thought were important. The first few topics are super-important. The rest is just good.

Shaded-3-D Graphic Packages!

We have come to the point where you can get shaded-3-D graphic systems from a number of suppliers.

It used to be that if you wanted a shaded-surface simulator for pretend aerial dogfights or anything else, there was only one turnkey supplier. Evans and Sutherland, of course: a name synonymous with the highest-quality graphics equipment. And E&S is still the top of the line, and the only serious real-time simulator that is commercially available. Those that can afford it know whom to call; it's not even at the booth.

(Unfortunately, the high-ticket nature of the equipment has had its effects on the E&S salesmen, some of whom were too haughty and busy talking among themselves to want to talk to passersby.)

But now there's turnkey software. Brigham Young University is offering (by brochures found on tables) a full shaded-3-D movie package for only $1000 ($500 to nonprofit organizations). It's a big time-sharing Fortran program for 32-bit machines combining Watkins graphics, Gouraud shading and animation, with slicing, labelling and titling. A Tektronix option, also offered, would seem to be a must for input and control of the thing. (Contact: Hank Christiansen, Civil Engineering, 368 CB, Brigham Young University, Provo, UT 84602.) They also offer a version for 16-bit machines.

Digital Effects of New York was not advertising it in the booths, but they are offering 3-D graphics software also. Unlike the Brigham Young Fortran packages, it is programmed in C, perhaps making it the connoisseur's choice. Prices are negotiable, as I understand it. (Talk to Judson Rosebush.)

Ikonas, of Raleigh, NC, offers shaded surface generation in a mix of hardware and firmware. The Ikonas full system package, at about $60K, essentially allows real-time surface generation in firmware refreshment of a real-time frame buffer. It's a fast bit-slice device. (They actually handed out a bit-slice primer, which is the wrong level of explanation and surely the other extreme in sales slickness from E&S. The $60K price is a lot less than the millions you'll need for an Evans and Sutherland system, friend, but it's not yet exactly a slick turnkey package. The pictures are beautiful but it's not clear how many surfaces they can handle.

Megatek, which has long been selling interactive 3-D line-drawing systems, has found an ingenious new way to add surface display to their 3-D vector processor. It's actually a simple add-on, a circuit card! The price of the basic Megatek "Whizzard" box is $60,000 with 128K of vector memory—which at 2 or 4 bytes per vector, gives you a lot of lines. A new word in the display list, recognized by the add-on card, says "fill between the following vectors;" the add-on color surface card looks at the brightness and color bits; firmware then takes care of the buffer fill. It works for both convex and concave surfaces (as many do not), and permits islands and holes. However, color is somewhat raw (only 16 colors from a 4K palette).

Comin' At Ya

The first commercially-available three-dimensional viewing system for 3-D data that requires no glasses is now available: the Genisco SpaceGraph, $100K.

SpaceGraph is essentially a 3-D terminal (or perhaps you might say a viewing booth). It uses a pulsating Mylar mirror (actually sealed over a woofer) to alter the apparent position of a reflected CRT.

You think you're seeing a white wire-frame image in space; actually you're looking into a throbbing sheet of Mylar, and that Mylar sheet is in turn reflecting a CRT image. (I described this in *Computer Lib*, but in those days it was a lab toy.)

Naturally, the actual displaying of the image on the CRT is extremely tricky: from the programmer's point of view, there are 32,000 virtual frames, one in front of the other like a deck of cards, and each capable of holding *one dot*. You, the programmer, or a picture compiler for this device, slice the picture-volume front-to-back like a carrot, dividing the available dot-times into whatever stack of dots must be presented to make your effect.

Anyway, the effect is fabulous. (And it's *almost* ready to market as a video game—with a little more software and a dollar bill slot.)

80 COLUMN GRAPHICS

The Integrated Visible Memory for the PET has now been redesigned for the new 12" screen 80 column and forthcoming 40 column PET computers from Commodore. Like earlier MTU units, the new K-1008-43 package mounts inside the PET case for total protection. To make the power and flexibility of the 320 by 200 bit mapped pixel graphics display easily accessible, we have designed the Keyword Graphic Program. This adds 45 graphics commands to Commodore BASIC. If you have been waiting for easy to use, high resolution graphics for your PET, isn't it time you called MTU?

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The image on the screen was created by the program below.

```
 10 VISMEM: CLEAR
 20 P=160: Q=100
 30 XP=144: XR=1.5*3.1415927
 40 YP=56: YR=1: ZP=64
 50 XF=XR/XP: YF=YP/YR: ZF=XR/ZP
 60 FOR ZI=-Q TO Q-1
 70 IF ZI<-ZP OR ZI>ZP GOTO 150
 80 ZT=ZI*XP/ZP: ZZ=ZI
 90 XL=INT(.5+SQR(XP*XP-ZT*ZT))
100 FOR XI=-XL TO XL
110 XT=SQR(XI*XI+ZT*ZT)*XF: XX=XI
120 YY=(SIN(XT)+.4*SIN(3*XT))*YF
130 GOSUB 170
140 NEXT XI
150 NEXT ZI
160 STOP
170 X1=XX+ZZ+P
180 Y1=YY-ZZ+Q
190 GMODE 1: MOVE X1,Y1: WRPIX
200 IF Y1=0 GOTO 220
210 GMODE 2: LINE X1,Y1-1,X1,0
220 RETURN
```

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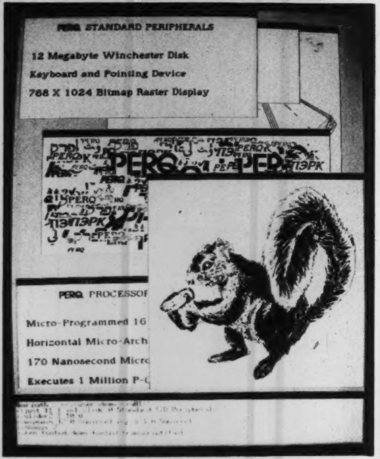
The PERQ

The PERQ from Three Rivers is the first to be commercially available of the new breed of super personal computers. These are the ones in the $15K to $40K class, with high-performance CPUs, big bit-map screens (500 by 1000) and Winchesters.

The prototype, of course, was the Alto from Xerox Palo Alto Research Center, designed by Alan Kay and supposedly never advertised or sold (but with lots of peeking allowed by research colleagues, and various Prestige Placements).

PERQ was announced as a product two years ago, and is now being delivered. Announced but mostly not yet delivered are the Xerox Star (kid brother of the Alto), the Apollo, and various academic boxes with commercial potential: the Lisp machine, the Nu-machine from MIT, and consoles from such other places as Carnegie-Mellon and Stanford.

Anyway, here were PERQs, several of them, zipping away, each presenting a super little movie on its screen that showed its fonts, its animation—what can I tell you. It's wonderful but pointless to describe.


PERQ STANDARD PERIPHERALS
12 Megabyte Winchester Disk
Keyboard and Pointing Device
768 X 1024 Bitmap Raster Display
PERQ
PERQ PROCESSOR
Micro-Programmed 16
Horizontal Micro-Arch
170 Nanosecond Micro
Executes 1 Million P-

The PERQ screen displays its fonts and animation.

Frame Buffers

There were plain frame buffers from DeAnza, Cromemco (low price, high performance and Cromemco reliability); Genisco; Datacube—offered for the Multibus.

Raster Technologies Inc. offers a powerful frame buffer—1K by 1K by 6 bits (thus offering 64 levels of gray or colors), or 512 by 512 by *24* bits—offering as many graydations as anybody could want, or perhaps useful as a z-buffer. It's $19K. (Their brochure shows a shaded picture of some sort of robot arm. Unfortunately, the picture misled everybody into thinking you could get the shaded-surface software from them. They're not offering the software—yet.)

But the People's Choice was clear. Advanced Electronic Design, Inc. AED was at the big Siggraph in '79, but it looked like a two-man outfit back then; now it's really big.

There was a constant crowd at the AED booth. The AED is the only affordable (under $15,000) color frame buffer, in a terminal configuration offering lovely color, smooth scroll and pan, 512 x 483 pixels with 256-color palette box. The AED box also offers subdivided animation of co-stored frames, and even "polygon fill," which is just short of 3-D shaded graphics.

It's just on the threshold of what a boy or girl filmmaker might be able to afford.

Gorgeous. It emulates a Tektronix but adds reconfigurable bit-mapping, recirculating animation, downloadable microcode. And it's just on the threshold of what a boy or girl filmmaker might just be able to afford.

CAD/CAM

Vectoring displays for CAD/CAM—designing physical equipment on screen—was all over: Vector General, Data Tech, Adage, Vector Automation, Imlac, Lundy, Megatek, Harris and of course Evans and Sutherland.

Applicon offered an interesting variation: software for CAD/CAM with shaded color screen output.

A high-resolution display was introduced for the VAX by DEC, also targeted for CAD/CAM but obviously applicable for other vectoring markets—if there are any at those prices.

A desktop VLSI design system was offered by Redac; a color VLSI design system is available from Applicon.

Hi-Res Hardcopy And Film Boxes

Dicomed was there; they offer the top-of-the-line output camera for squirting computer-generated movies from the computer onto film.

But coming up fast is MacDonald Dettwiler Associates, who presently make an extremely high-resolution laser printer for single photographs. I talked to David J. Nims, their extremely bright manager, and asked if the pressures at the show would influence them to make a movie-film recorder. He said there had been a lot of pressure to that effect, and that, indeed, they might.

So far nobody has opened a service bureau that will make movies from your disks and tapes. There will be an enormous demand but nobody seems to know it. Maybe it's destined to be done by Fotomat.

The Usual

There was, of course, 3-D vectoring from Lundy, Megatek, E&S, Interactive Machines Inc.

There were color terminals from Terak, Phoenix, IDT, Lundy, Datamax, Ramtek, Tektronix and Chromatics—whose equipment ran from $4K to a top-of-the-line $24K, with 68000 processor and Unix operating system.

And, of course, there was a variety of high-resolution picture input scanners, such as Optronics. And various business graphics packages requiring mainframes, such as DISSPLA and MIRAGE.

Whatever

A company called "Superset" offered a high-performance bit-slice Fortran engine for under $30K, able to compile and run Fortran subroutines at blast rates, fed by another machine. Hmm, put that together with Brigham Young's shaded-3-D software package, a Dicomed camera and you've got yourself a studio....

A crowd favorite was the three-dimensional sonic input pen from Science Accessories (Southport, CT), offering full spatial input for about the usual cost of an industrial tablet.

A firm called Lyon/Lamb sold a videotape controller whose purpose was to add frames sequentially to videotape from any cartooning or graphic system, computer or not. Their sample videotape had a naked lady with nipples, perhaps a first for a computer conference.

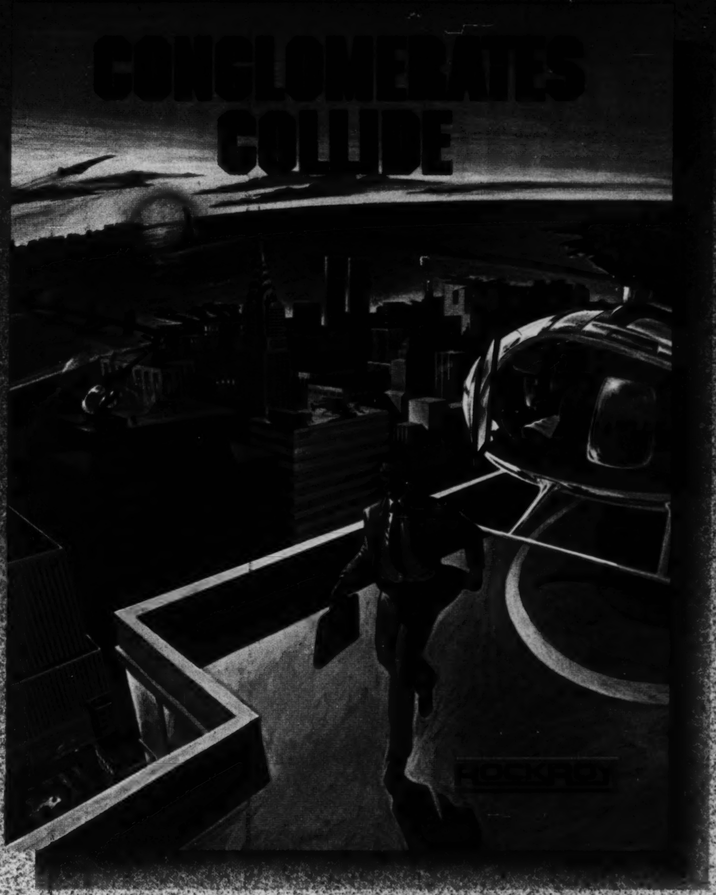
General Electric showed its big projection TV monitor. Sharp, all right. (They advertised a color model, but exhibited the black-and-white.) $60K color, $53K in black and white.

At the very bottom of the price scale, RCA had its terminal-inside-keyboard there, looking for dealers. Also on the low side of prices, West Coast Consultants was offering 2-D graphics software for the Apple and Atari.

Apple had a booth (why not). I believe they were the only usual personal computer manufacturer to exhibit.

A color conversion (factory only) for the DEC VT100 terminal was offered by ID Systems Corp. (This may have been shortcircuited by DEC's recent announcement that the VT100 can be converted to a Z80 computer.)

The only blatantly non-industrial pitch: Datamax pushing DeFanti's Zgrass language with their computer for "artists and communicators." ☐



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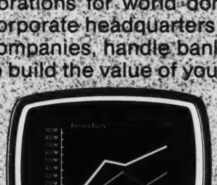

Each player's progress is instantly charted with RockRoy's exclusive color line performance graph (Illustrated). Easy to learn rules and 3 different game play options: solitaire, 2-4 players, or multiple computer opponents. For high scoring "Chairmen of the Board" each game disk comes with 3 entries to the RockRoy prize competition.

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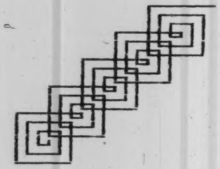
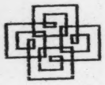
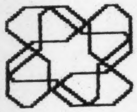
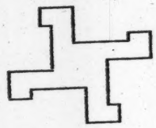
How to Solve It—With the Computer

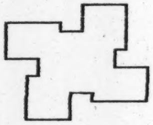


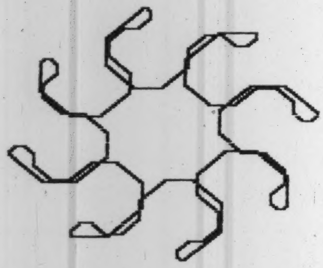


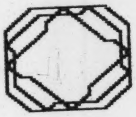


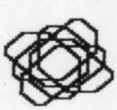


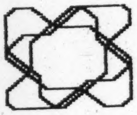
Spirolaterals











Donald T. Piele

I gave a talk recently to the Rotary Club in Racine, WI, about the virtues of personal computers. As I usually do, I spent a few minutes explaining how computers can be used in education—CAI, simulation, programming, problem solving—the usual laundry list. And then I paused for a moment to wax philosophical.

"You know, one of the primary results that we have always expected from mathematics courses is that they teach our students how to think logically and clearly for themselves. Mathematics is so clear and precise—what better subject could there possibly be to teach this very important skill? Teachers of mathematics appreciate the difference between rote learning and concept development and try very hard to teach concepts. It is not easy, and most of us are not very effective at it. As a consequence, we emphasize what we know everyone can learn—the manipulative skills.

"Mortimer Adler tells us, 'The idea is to teach not by telling but by asking.' This is a nice expression, but it is not easy to carry out in the classroom. As teachers, we are programmed for telling. Unfortunately, this is the least effective method for teaching logical thinking and problem solving skills. But there is another approach. It uses a device that *asks* each user to be completely logical, and if he is, it will ask him to try again. It is an instrument that will explore to the bitter end the consequences of any algorithm the student asks of it. It is a machine that students love to ask. It's a microcomputer."

Afterwards, one of the Rotarians in the audience came up, introduced himself and said, "I know exactly what you are talking about because of what happened to my son after we purchased an Apple II. He was doing very poorly in school. He really didn't care whether his written ideas were accurate or spelled correctly or whether his mathematics assignments were done. Then he got involved in teaching himself to program, and now I can't even keep up with him. In fact he just submitted a program to a computer magazine, and they are going to publish it and pay him $100. And his grades—you wouldn't know it was the same kid.

Problem Solving

This was not the first time I had heard about or seen the effect of computers on kids, and I'm sure that many of you have seen or even felt it yourselves. What this suggests to me is that we should pay careful attention to what the computer can do *to* kids and not so much on what it can do *for* kids. Sure we can write the programs to tell kids about any subject we want, perhaps in a more dynamic and interesting way than has been possible before. But that is just another form of telling. How can we set up part of the curriculum to let the students ask themselves the questions we haven't even thought of yet? Why can't we let each student learn what it means to be an independent problem solver. And won't the skills learned in this context be applicable to many other environments entirely separate from mathematics or computing? Isn't this what the National Council of Teachers of Mathematics had in mind in its recommendation for the 1980's to take full advantage of computers in the development of problem solving skills?

Donald T. Piele, University of Wisconsin-Parkside, Box 2000,
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CIRCLE 107 ON READER SERVICE CARD

The Four Phases of Problem Solving

In 1945, George Polya outlined what he considered to be the four phases of problem solving in his book, *How To Solve It*. It is interesting to compare these steps with the corresponding steps that a programmer must go through to write a complete and correct program. If we accept his four phases of problem solving as generally valid, then since writing a program is a problem itself, its solution should follow the stages set forth by Polya.

Notice how specific each step becomes when it is translated into its programming equivalent. Every successful program that a student writes is another successful problem solving experience. If the programming problems are selected properly, each student is able to create an original solution. And for some reason which I do not fully understand, students are highly motivated to stick with a programming task until it is absolutely perfect. What a golden opportunity we have in mathematics today to pump new life into the teaching of problem solving.

The Four Phases of Problem Solving

Polya	Programming
1. Understand the problem	*1. Understand the task*
a. What are the givens?	a. What is the input?
b. What are the goals?	b. What is the output?
c. What are the conditions?	c. What relationships exist between the variables?
2. Devise a plan	*2. Structure the program*
a. Employ subgoals	a. Use subroutines
b. Look for patterns	b. Write algorithms
3. Carry out the plan	*3. Write the program*
a. Make adjustments	a. Correct the errors
b. Does it work?	b. Does it run correctly?
4. Look back	*4. Review the program*
a. Complete and correct each detail	a. Debug the program
b. Make each part as simple as possible	b. Simplify the program
c. Scrutinize the methods that led to the solution	c. Document the program

Let's turn to a specific example of a programming activity that has both mathematical and programming interest.

Spirolaterals I

A collection of geometric patterns, called spirolaterals, is generated from a very simple set of logically constructed rules. On a sheet of rectangular graph paper, begin by imagining that you are a robot standing at a point in the middle of the paper and facing north. An instruction in code form has been placed into your memory and the RUN button pushed. The code reads simply—RRR. You know exactly what to do because

SHADOWHAWK 1

A LONE SPACE PIRATE ATTACKS THE GALACTIC EMPIRE

You are the sole surviving Naval Commander of the Free Space Confederation. The Galactic Empire has overrun the entire solar system . . . **except** for your remote outpost on a moon at the outer limits. Exploiting the unmatched ship **SHADOW HAWK I**,™ you prey on the Empire's merchant fleet to capture enemy material, which can be bartered for better weaponry, shielding, missiles, etc., for **SHADOW HAWK I**.™ But the Empire's interceptors, corvettes, lancers, destroyers, and cruisers are probing the galaxy for you. You must evade them and the deadly battle stations throughout. Your skill is measured by nine rankings, up to **STAR LORD.** Warning: You must be very, very good to reach **STAR LORD** rank! Very good indeed!

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HORIZON SIMULATIONS

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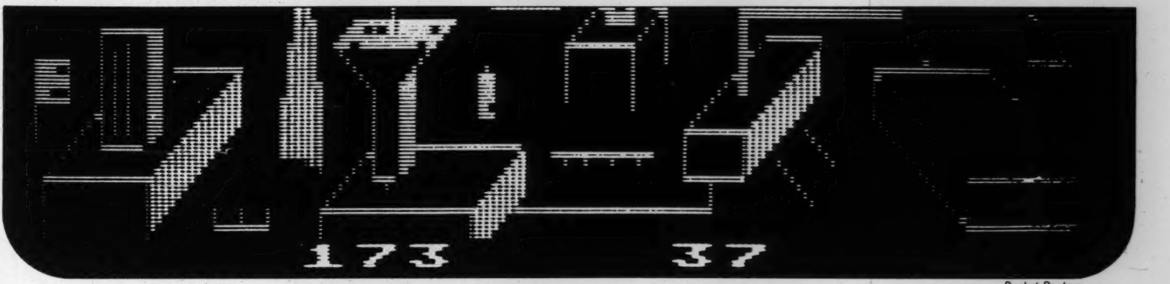

Rocket Raiders

Our High Quality Software Is More Than A Stroke Of Genius... It's A Work Of Art.

☐ **PM EDITOR:** by Dennis Zander (Atari, 16K)
Create your own fast action graphics game for the Atari 400 or 800 using its player missile graphics features. By using player data stored as strings, players can be moved or changed (for animation) at machine language speed. All this is done with string variables (PO$(Y)=SHIP4). This program is designed to permit creation of up to 4 players on the screen, store them as string data and then immediately try them out in the demo game included in the program. Instructions for use in your own game are included. PM EDITOR was used to create the animated characters in **ARTWORX** RINGS OF THE EMPIRE and ENCOUNTER AT QUESTAR IV.
PRICE .... **$29.95** cassette **$33.95** diskette

☐ **ROCKET RAIDERS** by Richard Petersen (Atari 24K)
Defend your asteroid base against pulsar bombs, rockets, lasers, and the dreaded "stealth saucer" as aliens attempt to penetrate your protective force field. Precise target sighting allows you to fire at the enemy using magnetic impulse missiles to help protect your colony and its vital structures.
PRICE .... **$19.95** cassette **$23.95** diskette

☐ **INTRUDER ALERT!** by Dennis Zander (Atari, 16K)
This is a fast paced action game in which you must escape from the "Dreadstar" with the secret plans. The droids are after you and you must find and enter your ship in order to escape. If you fail, the rebellion is doomed. **PRICE** .... **$16.95** cassette **$20.95** diskette

☐ **THE RINGS OF THE EMPIRE:** by Dennis Zander (Atari 16K)
The Empire has developed a series of battle stations protected by one or more rings of energy. You must destroy these weapons by attacking them in your Y-wing fighter armed with Zydon torpedoes. Each time you blast through the rings and destroy the station, the Empire develops a new station with more protective rings.
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☐ **FOREST FIRE!:** by Richard Petersen (Atari,24K)
Using excellent color graphics, your Atari is turned into a fire scanner to help you direct operations to contain a forest fire. You must compensate for changes in wind, weather and terrain. Not protecting valuable property can result in startling penalties. Life-like variables make FOREST FIRE a very suspenseful and challenging simulation. **PRICE** .... **$16.95** cassette **$20.95** diskette

☐ **GIGA TREK** by John Shepard
(Atari (16K), Apple, North Star and CP/M (M-BASIC).
Giga Trek has features not found in other "Star Trek" games including movement and a trigonometric coordinate system for navigation. It is your task during play to destroy the combined fleet of Klingons and Romulons that are menacing the Federation throughout the galaxy.
PRICE .... **$14.95** cassette **$18.95** diskette

☐ **ALPHA FIGHTER:** by Douglas McFarland (Atari, 16K)
Consisting of two different programs, ALPHA FIGHTER requires you to destroy the alien starships. As you become more successful, the games get harder and harder. **PRICE** .... **$14.95** cassette **$18.95** diskette

☐ **GIANT SLALOM:** by Dennis Zander (Atari, 16K)
Bring the Winter Olympics to your computer anytime of the year! Use the joystick to guide your skier's path down a giant slalom course consisting of open and closed gates. Choose from three levels of difficulty. Take practice runs or compete against from two to eight additional skiers.
PRICE .... **$15.95** cassette **$19.95** diskette

☐ **HODGE PODGE:** by Marsha Meredith (Apple 48K, Applesoft or Integer BASIC)
This captivating program is a marvelous learning device for children from 18 months to 6 years. HODGE PODGE consists of many cartoons, animations and songs which appear when any key on the computer is depressed. A must for any family containing young children and an Apple.
PRICE .... **$19.95** diskette

☐ **THE PREDICTOR** by Thomas Barker
(Apple, Atari, TRS-80, North Star and CP/M (M-BASIC).
This is a complete package that covers least squares fitting of parameters for two or more variables. THE PREDICTOR can be used for predicting sales and process behavior, trend analysis, model building and many other uses calling for multilinear regression techniques. Each option in the program is prompted with simple YES/NO commands making it **very** easy to use.
PRICE .... **$29.95** diskette

TYPE-'N-TALK*

ARTWORX is offering the fantastic TYPE-'N-TALK™ from Vortrax*. This easy-to-use unit connects to your computer's serial port. Text is automatically translated into electronic speech enabling the TYPE-'N-TALK™ hobbyist to use and enjoy it immediately.
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The following **ARTWORX** programs are available for TYPE-'N-TALK:

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TEACHER'S PET (Atari,24K; North Star)	**$16.95/ $20.95**
BRIDGE 2.0 (Atari, 24K; North Star)	**$19.95 / $23.95**
NOMINOES JIGSAW (Atari, 24K)	**$17.95 / $21.95**

Please specify "TNT" version when ordering programs.

☐ **CRANSTON MANOR ADVENTURE:** by Larry Ledden (Atari, North Star and CP/M)
You must enter mysterious Cranston Manor and attempt to collect its many treasures. This extemely challenging program will provide you with many hours (days?) of adventure. The program may be interrupted at will and your status saved onto the diskette.
PRICE .... $24.95 diskette

☐ **PILOT:** by Michael Piro (Atari, 16K)
Pilot your small airplane to a successful landing using both joysticks to control throttle and attack angle. PILOT produces a true perspective rendition of the runway, which is constantly changing. Select from two levels of pilot proficiency.
PRICE .... **$16.95** cassette **$20.95** diskette

☐ **TEACHER'S PET:** by Arthur Walsh (Atari, Apple, TRS-80, PET, North Star and CP/M (MBASIC) systems)
This is an introduction to computers as well as a learning tool for the young computerist (ages 3-7). The program provides counting practice, letter-word recognition and three levels of math skills.
PRICE .... **$14.95** cassette **$18.95** diskette

☐ **FORM LETTER SYSTEM:** (Atari, North Star and Apple)
This is the ideal program for creating personalized form letters! FLS employs a simple-to-use text editor for producing fully justified letters. Addresses are stored in a separate file and are automatically inserted into your form letter along with a personalized salutation. Both letter files and address files are compatible with **ARTWORX** MAIL LIST 3.0 and TEXT EDITOR programs.
PRICE .... **$39.95** diskette

☐ **TEXT EDITOR:** (Atari and North Star)
This program is very "user friendly" yet employs all essential features needed for serious text editing with minimal memory requirements. Features include common sense operation, two different justification techniques, automatic line centering and straightforward text merging and manipulation. TEXT EDITOR files are compatible with **ARTWORX** FORM LETTER SYSTEM.
PRICE .... **$39.95** diskette

☐ **MAIL LIST 3.0:** (Atari, Apple and North Star)
The very popular MAIL LIST 2.2 has now been upgraded. Version 3.0 offers enhanced editing capabilities to complement the many other features which have made this program so popular. MAIL LIST is unique in its ability to store a maximum number of addresses on one diskette (typically between 1200 and 2500 names!). Entries can be retrieved by name, keyword(s) or by zip codes. They can be written to a printer or to another file for complete file management. The program produces 1, 2 or 3-up address labels and will sort by zip code (5 or 9 digits) or alphabetically (by last name). Files are easily merged and MAIL LIST will even find and delete duplicate entries! The address files created with MAIL LIST are completely compatible with **ARTWORX** FORM LETTER SYSTEM.
PRICE .... **$49.95** diskette

☐ **THE VAULTS OF ZURICH:** by Felix and Ted Herlihy (Atari, 24K, PET)
Zurich is the banking capital of the world. The rich and powerful deposit their wealth in its famed impregnable vaults. But you, as a master thief, have dared to undertake the boldest heist of the century. You will journey down a maze of corridors and vaults, eluding the most sophisticated security system in the world. Your goal is to reach the Chairman's Chamber to steal the most treasured possession of all: THE OPEC OIL DEEDS!
PRICE .... **$21.95** cassette **$25.95** diskette

☐ **BRIDGE 2.0** by Arthur Walsh (Atari (24K), Apple TRS-80, PET, North Star and CP/M (MBASIC) systems)
Rated #1 by Creative Computing, BRIDGE 2.0 is the only program that allows you to both bid for the contract and play out the hand (on defense or offense!). Interesting hands may be replayed using the "duplicate" bridge feature. This is certainly an ideal way to finally learn to play bridge or to get into a game when no other (human) players are available.
PRICE .... **$17.95** cassette **$21.95** diskette

☐ **ENCOUNTER AT QUESTAR IV:** by Douglas McFarland (Atari, 24K)
As helmsman of Rikar starship, you must defend Questar Sector IV from the dreaded Zentarians. Using your plasma beam, hyperspace engines and wits to avoid Zentarian mines and death phasers, you struggle to stay alive. This BASIC/Assembly level program has super sound, full player missile graphics and real time action.
PRICE .... **$23.95** cassette **$27.95** diskette

☐ **THE NOMINOES JIGSAW PUZZLE:**
by C. Minns/B. Brownlee (Atari, 24K, TRS-80, and Apple)
We quote ... "A brainteaser supreme ... the concept of NOMINOES JIGSAW is brillant ... this video jigsaw game is so clever and completely original that only the most hardhearted puzzle hater could fail to be charmed."—ELECTRONIC GAMES MAGAZINE.
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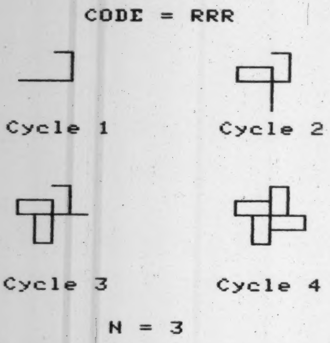


Figure 1.

you have been programmed to accept and act upon instructions that consist of a sequence of R's. To carry out the instruction RRR, you begin by turning right 90 degrees and walking forward one unit. Next you turn right again and this time walk forward two units. Then you turn right a third time and walk forward three units. Now you check to see whether you have returned to where you began—call it home. If you have, then you stop. If you have not returned home, then repeat the same sequence of moves—turn right and move one unit, turn right and move two units, turn right and move three units. Keep repeating this cycle of moves until you return home. The path you would trace out is called a spirolateral of order 3 (see Figure 1. Code= RRR and order N = 3).

The code is very simple. Each R indicates a right move and each move is one unit longer than the previous move. To complete a spirolateral, it is necessary to repeat the pattern of turns and moves in sequential order until the home position is reached. Surely a computer program can be written to trace out and study these elementary spirolaterals of order N, N = 1, 2, 3, 4....

Problem 1

Write a computer program that will accept an integer N and print out the Nth order spirolateral.

Discussion

We have defined the terms and set the task. The input must be an integer, and the output a pattern on the screen. Now it is up to the student to solve the problem. It seems to be a harmless enough problem—in the LOGO language with Turtle Graphics it is a snap. It could also be easily programmed in Pascal. But, like it or not, Basic is the language that everyone has available and in Basic this problem presents a nice challenge. Besides, most of us do not have the luxury of language options today. If you do, then by all means use them.

With the Apple II, there are three choices of formats that we could use to display each spirolateral. We could use the text screen with horizontal and vertical tabs—HTAB, VTAB, the low resolution graphics screen with PLOT commands, or the high resolution screen and HPLOT commands. It would be nice to have solutions in each of these formats. The major problem to be solved is how to represent the right turns. This is not a built-in function in Basic as it is in LOGO. The process which the students must go through to find out how to handle this problem is what problem solving is all about. Let them do it on their own. Let them ask questions. Let the computer be the final judge.

A Solution

In the usual cartesian coordinate system, a single step toward the north can be represented by the point (0,1). This is one unit north of the origin (0,0). Similarly, (1,0) is a single step in the easterly direction, (0,-1) a step in the southerly direction, and (-1,0) a step in the westerly direction.

N   (0.1)
W ┼ E   (-1,0) ┼ (1,0)
S   (0,-1)

Right turns result from clockwise movements in the direction the robot is facing as follows:

Right Turns

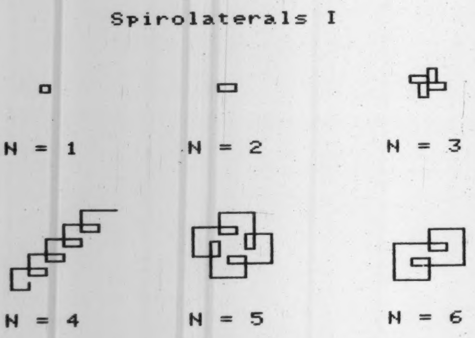
From	To	From	To
N	E	(0,1)	(1,0)
E	S	(1,0)	(0,-1)
S	W	(0,-1)	(-1,0)
W	N	(-1,0)	(0,1)

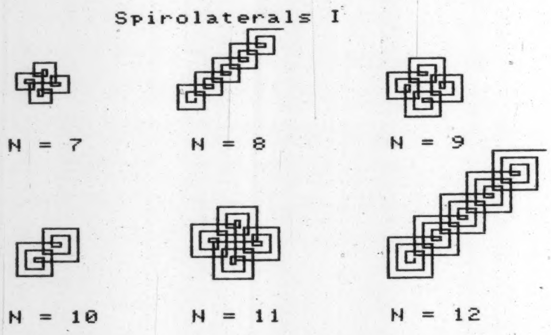
If (D1,D2) represents the current direction that the robot is facing, then what will be its new direction after a right turn? Can we find a simple algorithm that will work successfully for all four of the moves listed above? It appears that a right turn interchanges the D1 and D2 values and changes the sign of the second coordinate. This can be represented by

(D1,D2) → (D2,-D1).

This is carried out in Basic by performing a swap

```
T=D1
D1=D2
D2=-T
```





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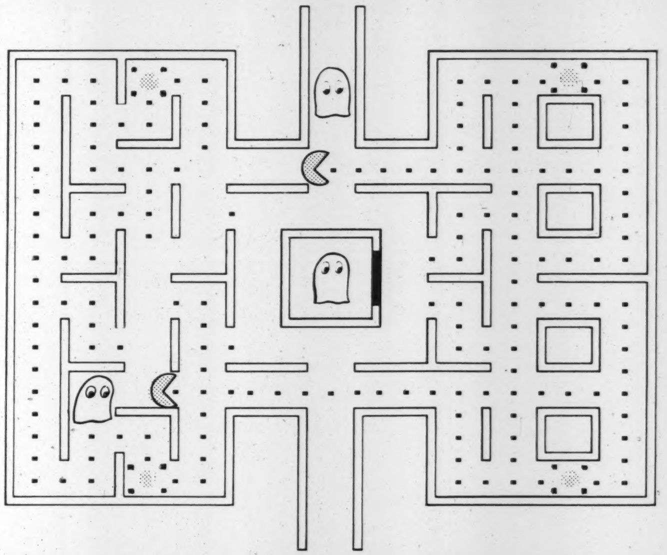

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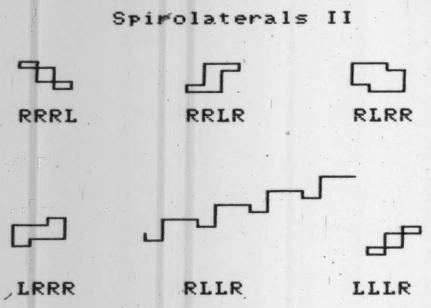

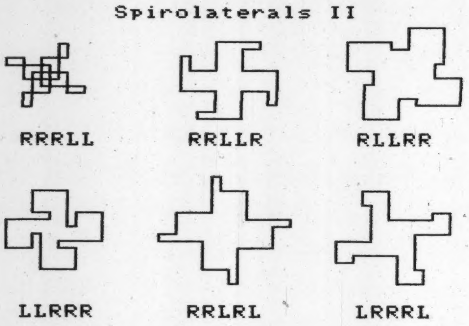

The Program

Listing 1 is a simple spirolateral program written in Applesoft Basic using the low-resolution graphics screen for the coordinate plane.

Listing 1.

```
10 REM   "SPIROLATERALS I - LOW RESOLUTION GRAPHICS"
20 REM   "DONALD T. PIELE"

30 TEXT : HOME
40        A  =  25 :  B = 20      :REM (A,B) is home.
50        X  =  A  :  Y = B       :REM (X,Y) is current
                                                postion.
60 INPUT "ENTER THE ORDER ";N

70     GR
80     D1=1 : D2=0                :REM (1,0) initial dir.
90     COLOR = 9 : PLOT X,Y       :REM Plot home orange.
100       COLOR = 15              :REM Set the path white.

110    FOR I = 1 TO N
120       T=D2 : D2=D1 : D1=-T    :REM Turn right.
130       FOR K=1 TO I
140          X=X+D1 : Y=Y+D2      :REM Move forward
150          PLOT X,Y                      I steps.
160       NEXT K
170    NEXT I

180     IF X=A AND Y=B THEN END   :REM Stop at home.

190    GOTO 110                   :REM Repeat the cycle.
```

Program Notes

The coordinate system on the low-resolution screen begins with the origin (0,0) in the upper left hand corner. When we established the directions for north, east, south, and west, we were working with the usual coordinate system, which places the origin in the lower left hand corner. Thus, the north—south direction on the Apple is just the opposite of what we are accustomed to, and the direction of (1,0) in line 80 actually faces south. Also, to get a true right turn on the screen we must use the expression in line 120.

The program listed above is a minimal one which can easily be embellished upon.

1. A check should be made each time a move is taken to see whether the robot has moved off the 40 x 40 low-resolution graphics screen. When this happens, one can either terminate the program or skip the next PLOT command. This is done by inserting the line

145 IF X<0 OR Y<0 OR X>39 OR Y>39 THEN 160.

2. The size of a single robot step can be easily changed in order to see the patterns more clearly. For example, to double the step size simply replace I in line 130 with 2*I.

3. The spirolaterals can also be drawn on the text screen. The major difference is that we must replace PLOT X,Y with its text equivalent HTAB X : VTAB Y : PRINT "*";. Since the text screen is only 40 x 24, we also need to adjust 'home' to A=20:B=12. If these adjustments are made and the GR and COLOR commands deleted, then the program will run on the text screen.

4. The high resolution screen is really the best place to draw spirolaterals. Here we have a 280 x 192 grid to roam around in. To switch to the high resolution screen a few changes must be made:

```
 40  A = 140 : B = 85
 70  HGR
 75  POKE -16302,0   : REM Set full graphics screen.
 90  HCOLOR=1 : HPLOT X,Y
100  HCOLOR=3
150  HPLOT X,Y
```

To avoid an error when the robot wanders off the screen, add the line:

```
145  IF X<0 OR Y<0 OR X>279 OR Y>191 THEN 160.
```

Spirolateral I Behavior

Writing a program to display spirolaterals is only half the fun. Investigating the properties of spirolaterals by running the program opens up all kinds of problem solving activities. In this mode, we are using the computer to extend our knowledge about the behavior of spirolaterals. There are a number of interesting questions that arise about these figures:

1) Which spirolaterals wander off the screen and never return home?

2) Some of the spirolaterals return home after two cycles of the code and some after four cycles. Is there any way to predict what will happen to a spirolateral of order N?

The answer, of course, is "yes" to both of these questions, and the search for a solution is a nice problem solving activity. It turns out that if N is a multiple of 4 (N mod 4 = 0), then the spirolateral wanders off the screen and never returns home. If N mod 4 = 1 or 3, then the spirolateral returns home after four cycles. If N mod 4 = 2, then it returns home in two cycles. Students usually have no difficulty arriving at the same conclusion, but they usually express it differently.

Spirolateral II

What would happen if we gave our robot the ability to turn left as well as right? For example, what would the spirolateral look like if the robot followed the instructions RRRL? or any other combination of Rs and Ls? Presto! We have a new problem.

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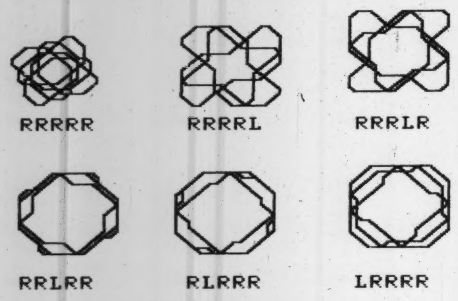
Spirolaterals III


RRRRR RRRRL RRRLR

RRLRR RLRRR LRRRR

Problem II

Write a program that will accept a sequence of Rs and Ls and draw out the corresponding spirolateral.

Discussion

Since the turns are no longer necessarily in the same direction, we must build into the program the ability to read a sequence of letters and act upon each instruction individually. This means we need to know how to handle strings.

A string of letters can be entered into the computer with the input statement, INPUT N$. Suppose we enter the sequence RRRL (N$="RRRL"). Each letter in this string can be examined through the use of the string function MID$(N$,I,1). The parameter I represents the position of a character in N$, as measured from left to right, and the number 1 specifies how many characters to read after the Ith position. Thus MID$(N$,1,1)="R" and MID$(N$,4,1)="L" if N$="RRRL".

The other thing we need to know, is how to make a left turn: (D1,D2)→(-D2,D1).

The Program

Listing 2 is a sample spirolateral program written in Applesoft Basic using the high-resolution graphics screen.

Listing 2.

```
 10 REM   "SPIROLATERAL II - HIGH RESOLUTON GRAPHICS"
 20 REM   "DONALD T. PIELE"

 30 TEXT:HOME
 40           A= 140 : B= 85     :REM (A,B) is home.
 50           X= A   : Y= B      :REM (X,Y) is current pos.

 60 INPUT "ENTER A STRING ";N$

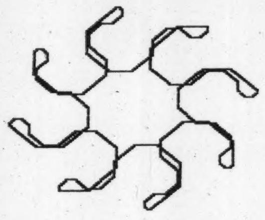
 70   HGR
 75   POKE -16302,0               :REM Set full graphics screen
 80   D1=1 : D2=0                 :REM (1,0) initial direction
 90   HCOLOR = 3                  :REM Set path to white
 95   HPLOT X,Y                   :REM Plot first point
100   N = LEN(N$)                 :REM N is the order

110   FOR I = 1 TO N
120     IF MID$(N$,I,1)="R"     :REM Right turn
          THEN T=D2:D2=D1:D1=-T
130     IF MID$(N$,I,1)="L"     :REM Left turn
140       THEN T=D1:D1=D2:D2=-T

150       FOR K=1 TO I
160         X=X+3*D1 : Y=Y+3*D2   :REM Move forward I steps
170         HPLOT TO X,Y
180       NEXT K

190   NEXT I
200    IF X=A AND Y=B THEN END
210   GOTO 110
```

Spirolaterals III


RRRRRLLLRRRRR

Program Notes

This is a "bare bones" program which can easily be changed to meet individual needs.

1. Each stop in line 140 is three dots long (3*D1,3*D2). This makes it easier to see the smaller spirolaterals. When the order, N, gets beyond 10 or so, a smaller step size works better.

2. A check in line 145 should be added to avoid an error when the robot wanders off the screen:

145 IF X<0 OR Y<0 OR X>279 OR Y>191 THEN 160.

Spirolateral II Behavior

We are now in a position to explore the behavior of these more versatile spirolaterals.

1. Suppose we call the number of cycles that it takes for a spirolateral to return home the *degree* of the spirolateral. Remember, the order is the length of one cycle. Do all spirolaterals of the same order have the same degree?

2. Under what conditions will the robot wander off the screen?

3. Is the degree of a spirolateral of order N completely determined by the number of Rs and Ls in the input string, or does it depend upon their arrangement?

4. Find a way to classify completely the degree of any spirolateral.

Spirolateral III

We are not done yet. What would happen if we added the ability of the robot to turn right or left at a fixed angle different from 90 degrees? Not only do we have a new and interesting programming problem, but we also have the same set of mathematical questions to answer as before, taking into account the new parameter—the angle of the turn.

Problem III

Assume that the robot can turn right to left at an angle of 45 degrees. Write a program that will accept a sequence of Rs and Ls and draw out the corresponding spirolateral.

Discussion

The only thing that needs to be changed in the previous program is the algorithm for a right and left hand turn. This is the crux of the problem—your problem. The solution will be given next month. The result should look like the figures shown under Spirolaterals III. ☐

References

1) Odds, Frank C. "Spirolaterals," *The Mathematics Teacher*, 66:121-24, February 1973.

2) Schwandt, Alice K. "Spirolaterals: Advanced Investigation From an Elementary Standpoint," *The Mathematics Teacher*, 72:166-69, March 1979.

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	Shugart Compatible, 32 Hard Sector	3015	1.99	470901	53802	101/1	–	FH1-32	FD-132	740-32	S/A-101	15025	FD32-9000	–	421322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3087	2.49	–	54491	–	–	–	–	740-32RH	–	–	–	F37A411X	–
	CPT 8000 Compatible	3045	2.69	–	–	–	–	–	–	–	–	15226	–	–	–
Flexible Disc 1d Single Headed Drives Double Density Media	IBM Compatible (128 B/S, 26 Sectors)	3090	2.69	474071	54568	3740/1D	–	FD1-128/M2100	FD-1D	741-0	–	–	FD34-8000	F131111X	423002
	Soft Sector (128 B/S, 26 Sectors) REVERSIBLE	3093	3.69	–	–	–	–	–	–	–	–	–	–	–	–
	Shugart Compatible, 32 Hard Sector	3091	2.69	470801	54596	101/1D	–	FH1-32D	–	741-32	S/A-103	15075	FD32-8000	F33A411X	423322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3088	3.09	–	–	–	–	–	–	–	–	–	–	–	–
Flexible Disc 2s Double Headed Drives Single Density Media	Soft Sector (128 B/S, 26 Sectors)	3113	3.09	–	54428	800814	1766870	–	–	–	S/A-150	15153	FD10-4026	F121111X	–
	Soft Sector (256 B/S, 15 Sectors)	3106	3.09	473477	54226	800815	2736700	FD2-256D	–	742-0	–	15154	FD10-4015	F122111X	424612
Flexible Disc 2d Double Headed Drives Double Density Media	Soft Sector (Unformatted)	3102	3.09	473485	–	DY150	–	FD2-XDM	FD-2D	743-0	–	15103	DD34-4001	–	425002
	Soft Sector (128 B/S, 26 Sectors)	3115	3.09	–	–	–	–	–	–	–	S/A-150	–	–	–	–
	Soft Sector (256 B/S, 26 Sectors)	3103	3.09	473471	54325	800817	1766872	FD2-256D	–	743-0/256	–	15101	DD34-4026	F144111X	425602
	Soft Sector (512 B/S, 15 Sectors)	3114	3.09	473472	54479	800818	1669044	–	–	743-0/512	–	15100	DD34-4015	F145111X	425612
	Soft Sector (1024 B/S, 8 Sectors)	3104	3.09	473473	54485	800819	1669045	–	–	743-0/1024	–	15102	DD34-4008	F147111X	425622
	32 Hard Sector	3105	3.09	470851	–	101/2D	–	FH2-32D	–	743-32	S/A-151	15125	DD32-4000	F34A411X	425322
	Burroughs B-80 Compatible, 32 Hard Sector	3092	3.09	–	–	–	–	–	–	–	–	–	–	F34A611X	–
	Soft Sector (1024 B/S, 8 Sectors) w/ Hub Ring	3116	3.49	–	–	–	–	–	–	–	–	–	–	–	–
	Shugart Compatible, 32 Hard Sector	3181	3.39	–	–	–	–	–	–	–	–	–	DD32-4000	–	–
Flexible Disc FD Memorex 651 or Equiv Drive Compatible	FD VI (Vinyl Jacket)	30712003	2.69	470651	–	FDIV	–	–	FD-165	511-0	–	15026	FD65-1000	F61A111X	–
Mini Flexible Disc 1s 5¼" Single-Headed Drives Single-Density Media	Soft Sector (Unformatted)	3401	1.94	475001	54256	104/1	–	MD1	MD 1	744-0	S/A-104	15300	MD525-01	M11A211X	441002
	10 Hard Sector	3403	1.94	475010	54257	107/1	–	–	MD 110	744-10	S/A-107	15325	MD525-10	M41A211X	441102
	16 Hard Sector	3405	1.94	475016	54258	105/1	–	MH1	MD 116	744-16	S/A-105	15326	MD525-16	M51A211X	441162
	Soft Sector (Unformatted) w/Hub Ring	3431	2.14	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector, w/Hub Ring	3433	2.14	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector, w/Hub Ring	3435	2.14	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 1d 5¼" Single-Headed Drives Double-Density Media	Soft Sector (Unformatted)	3417	2.14	–	54646	104/1D	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector	3418	2.14	–	54649	107/1D	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector	3419	2.14	–	54652	105/1D	–	–	–	–	–	–	MD525-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3481	2.34	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector w/Hub Ring	3483	2.34	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector w/Hub Ring	3485	2.34	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 2d 5¼" Double-Headed Drives Double Density Media	Soft Sector (Unformatted)	3421	2.59	–	54624	104/2D	–	–	–	–	S/A-154	–	MD550-01	–	–
	10 Hard Sector	3423	2.59	–	54627	107/2D	–	–	–	–	S/A-157	–	MD550-10	–	–
	16 Hard Sector	3425	2.59	–	54630	105/2D	–	–	–	–	S/A-155	–	MD550-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3491	2.79	–	–	–	–	–	–	–	–	–	MD550-01	–	–
	10 Hard Sector w/Hub Ring	3493	2.79	–	–	–	–	–	–	–	–	–	MD550-10	–	–
	16 Hard Sector w/Hub Ring	3495	2.79	–	–	–	–	–	–	–	–	–	MD550-16	–	–

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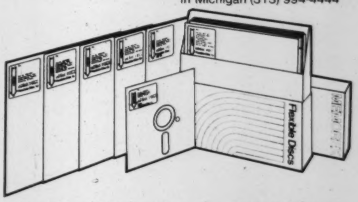

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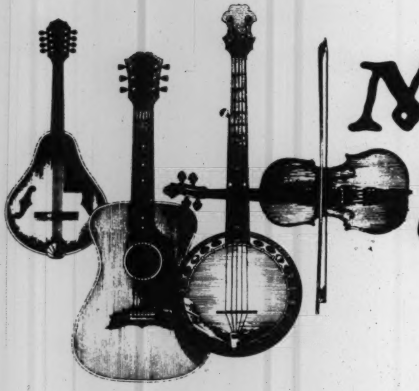

Musical Subroutines

Phil Tubb

Phil Tubb is the inventor of the ALF Music Synthesizers. Here he shares his thoughts on the importance of subroutines in a computer music language.

Lightning flashes through the pale glow of a full moon peeking through deep black clouds. Thunder explodes through the howling winds as they sweep up the mountain peak to a desolate and decaying mansion whose musty interior is filled with the dim phosphor glow of rows of computer displays. Mad scientists and their demented assistants are gathered around a computer from which alien sounds drift forth.

It is the stroke of midnight, and researchers at ALF Products are about to realize the culmination of a fiendish undertaking—the joining of programming subroutines and a music notation language. "It will never work," screams Allen L. Foster, "God will punish us for trying!"—but the music proves him wrong: the marriage of music and subroutines is done and no power on Earth can separate them.

Years have passed since that fateful night, and the bond between music and subroutine programming has grown and strengthened. The pair have remained faithful to their masters, and even today impressive music subroutine capabilities are found in some music languages. In this article, I shall describe the secret behind their awesome power.

Turn on the radio, and chances are you'll hear a song that goes something like this: a first verse followed by a second verse, then a guitar and/or synthesizer solo, and finally a third verse. If you are programming that song into a computer, you won't want to have to program each verse in separately; you would rather program it once and have it played back three times since all three repetitions are identical.

Some of the early music notation schemes allowed you to put a "start repeat" before the first verse, then put a "repeat" command at the end of the verse to cause the second verse to occur. Then you could program the solo, but you would have to enter the verse again to have it play the third time.

While this scheme has the advantage of looking a great deal like sheet music ("start repeat" is ‖: in sheet music and "repeat" is :‖), you can see it is rather limiting. In sheet music, a complex scheme of "first and second endings," "*Da Capo*," "*Dal Segno*," "*al Fine*," "*al Segno*" and so forth is used. While these are convenient for performers they are not particularly useful in a music notation language for computer-controlled playback.

The repetitious nature of music is very similar to the repetitious nature of computer algorithms.

The repetitious nature of music is very similar to the repetitious nature of computer algorithms. In programming languages, one of the most common ways to allow an algorithm to be used from several points in the program is to use subroutines. Subroutines can be applied to music notation very effectively. In the radio example, one would simply create a subroutine which consists of the verse; the musician would alert the computer program that a subroutine is required and then enter the notes of the verse "into" the subroutine structure provided by the music language. (Note: only a few of the popular music languages have a subroutine capability.)

When the verse is fully entered, the musician alerts the computer program that the subroutine is complete and goes to the "normal" entry procedure. If no subroutine or repeat functions were available, the musician would start the song by entering the verse, then he would enter the verse again for the second playing, then enter the solo, and finally enter the verse yet again for the third time playing.

With the subroutine capability just mentioned, the musician would simply enter a command referencing the subroutine, which would serve as the first playing, then enter the command again to use the subroutine for the second playing, then enter the solo, and finally enter the subroutine reference a third time for the third playing. If the verse consisted of 300 commands and the solo of 200 commands, the no-subroutine entry method requires the entry of 1,100 commands (3 times 300 for the verses plus 200 for the solo), whereas the subroutine method requires 505 commands (one to create the subroutine, 300 for the verse, one to end the subroutine, two subroutine calls, 200 for the solo, and one more for the final call). You can see that a great deal of work will be saved by using subroutines, and very long pieces often save even more commands than this example.

Most music is "polyphonic" ("poly"—many, "phonic"—sounds). That is, more than one pitch is played at a time. Several pitches may be played simultaneously to sound a chord, or because more than one instrument is playing at the moment, or

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Softlights

By Fred Huntington

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for maybe a combination of these reasons. For a variety of technical reasons, most music notation languages for playback use a multiple monophonic ("mono"—one) approach where the original polyphonic score is broken into several monophonic "voices" or "parts." Each monophonic part plays only one pitch at a time.

Figure 1.

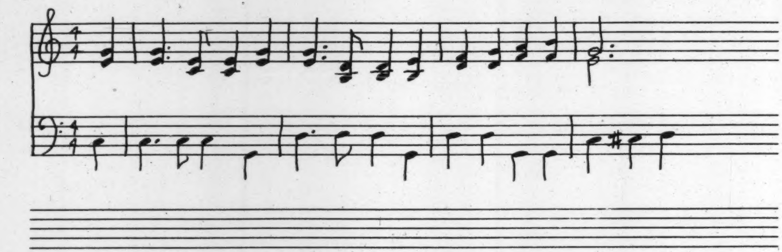
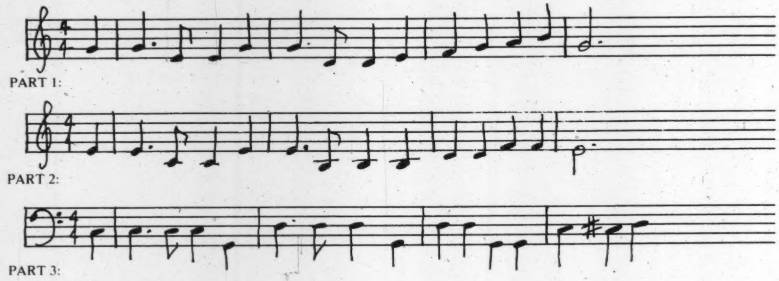


Figure 2.



Lest we begin an unnecessary explanation of why these schemes seem to be easiest to use, let's stipulate that multiple monophonic entry is in fashion this season. Figure 1 shows the beginning of the sheet music for "America, the Beautiful" (or "Materna," if you prefer); meanwhile Figure 2 shows how this would commonly be broken into three monophonic parts. During playback, each of these parts is processed (and thus played back) simultaneously so the song sounds the way it is shown in the original sheet music (Figure 1).

We all know that "America the Beautiful" has several verses, and is no doubt, thus, a candidate for subroutines. By allowing each part to call a subroutine, this is easily accomplished. Each monophonic part is programmed into a different subroutine, as shown in Figure 3. To play the song with four verses, each part is programmed as shown in Figure 4. This presents the author of the music notation language/playback system with a small challenge since each part can simultaneously have a subroutine call active (further, some parts may call a subroutine while others do not).

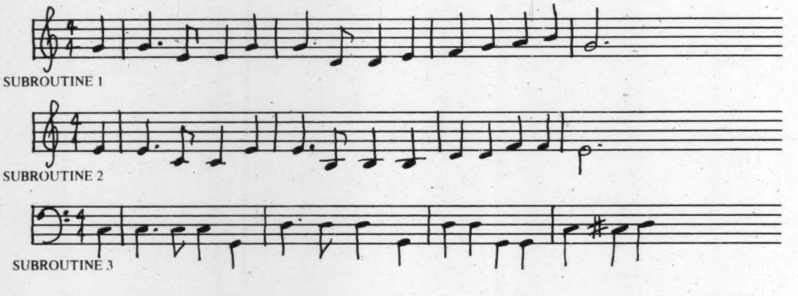
Obviously, complicated repetitions are easily mastered. A part may consist of CALL VERSE A, CALL CHORUS, CALL VERSE B, CALL CHORUS, CALL VERSE A, (solo programming), CALL VERSE B, (additional solo), CALL CHORUS, (flashy ending) in which three subroutines are used (VERSE A, VERSE B, and CHORUS) and two solos and an ending are programmed "in place" without using subroutines. Of course if the two solos were identical, another subroutine would be used to avoid entering the solo twice. In a polyphonic song with two parts, six subroutines (VERSE A1, VERSE A2, VERSE B1, VERSE B2, CHORUS 1, and CHORUS 2) would be needed so each part would have its own set of subroutines.

> ***The music language author must take various precautions to make sure each part winds up at the right subroutine and comes back to the right place.***

Often, a section of a song is played two or more times but the ending is different each time. This is easily programmed by putting only the start of the section, which is the same in each playing, in the subroutine. The part is then programmed as CALL THEME, (programming for first ending), (programming for melody until "theme" occurs again), CALL THEME, (programming for second ending), (more programming), CALL THEME, (programming for third ending), and so on.

Similarly, a section that is played at several points but begins differently can be programmed, as can a theme which starts and ends differently. [Note that my choices for subroutine names such as VERSE, CHORUS, and THEME are chosen at random. In some music languages the subroutines are numbered rather than named, just as subroutines are numbered in Basic (GOSUB 50).] With a little imagination and an eye for notes that occur more than once, you can save a great deal of entry effort by making extensive use of subroutines.

Figure 3.



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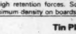

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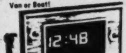

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P807	10	16	.23	2.07
P808	22		.27	2.28
P809	33		.29	2.43
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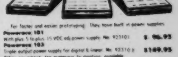

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CIRCLE 146 ON READER SERVICE CARD

Musical Subroutines, continued...

So far, you get the impression that since there are n sections to be repeated and i monophonic parts, you'll always have n times i subroutines. In some systems this is true, but in more sophisticated systems you can do some interesting things with subroutines. Cast your eyes on Figure 5 which shows the sheet music for "Row, Row, Row Your Boat." The more astute readers, knowing that song is a "round," will know what's coming up.

Figure 6 shows how "Row, Row, Row Your Boat" is normally played (or sung as the case may be). It certainly *looks* repetitious, but not in the same fashion as the previous examples. Using subroutines, it is easy to program the melody shown in Figure 5 into a subroutine, which I shall call MELODY. Now to achieve a playback as shown in Figure 6, part 1 should be programmed as CALL MELODY, (four whole rests); part 2 should be programmed as (two whole rests), CALL MELODY, (two whole rests); and part 3 should be programmed as (four whole rests), CALL MELODY.

You will notice that at one point the subroutine MELODY is being called by all three parts at once, though none will be at the same note within the subroutine as the other two. The music language author must take various precautions to make sure this all gets sorted out properly and each part winds up at the right subroutine and comes back to the right place (but since the language designer has done this work, the music language user will never have to give it a thought). We could add another CALL MELODY after each CALL MELODY already present if we wanted the song to play longer, and, obviously, additional parts could be added.

In a round (or fugue) it is probably desirable to have different sound parameters assigned to each part so they don't "blend" together. This is usually done either by having separate sound specifications for each voice (in simple systems) or by having sound specifications which can be changed at any point in the music. With the more advanced "any point" scheme, each voice would set up different sounds before calling the MELODY subroutine. Additionally, the first part might read: (set up mellow sound), CALL MELODY, (set up funky sound), CALL MELODY, (rest) so that the second repeat of the round can sound different.

This brings up another common use of subroutines in some music languages. Sounds are specified using one or more commands (such as Attack, Decay, Sustain, Release, and so on). If a sound change requires the use of three or four commands, many musicians simply place these sound change commands in a subroutine. This subroutine can be called at any point

Figure 4.

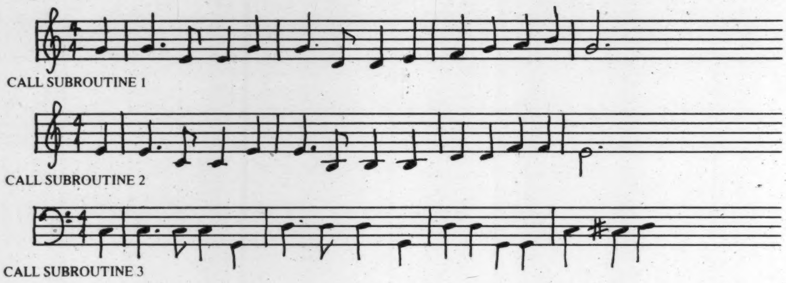

CALL SUBROUTINE 1
CALL SUBROUTINE 2
CALL SUBROUTINE 3

Figure 5.

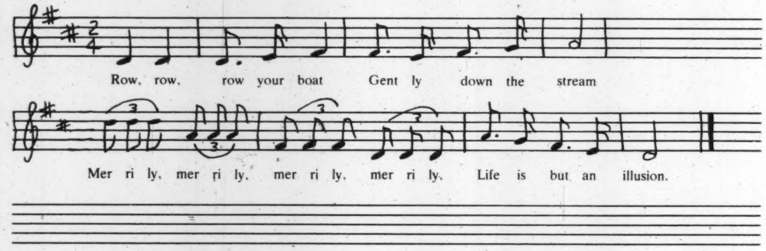
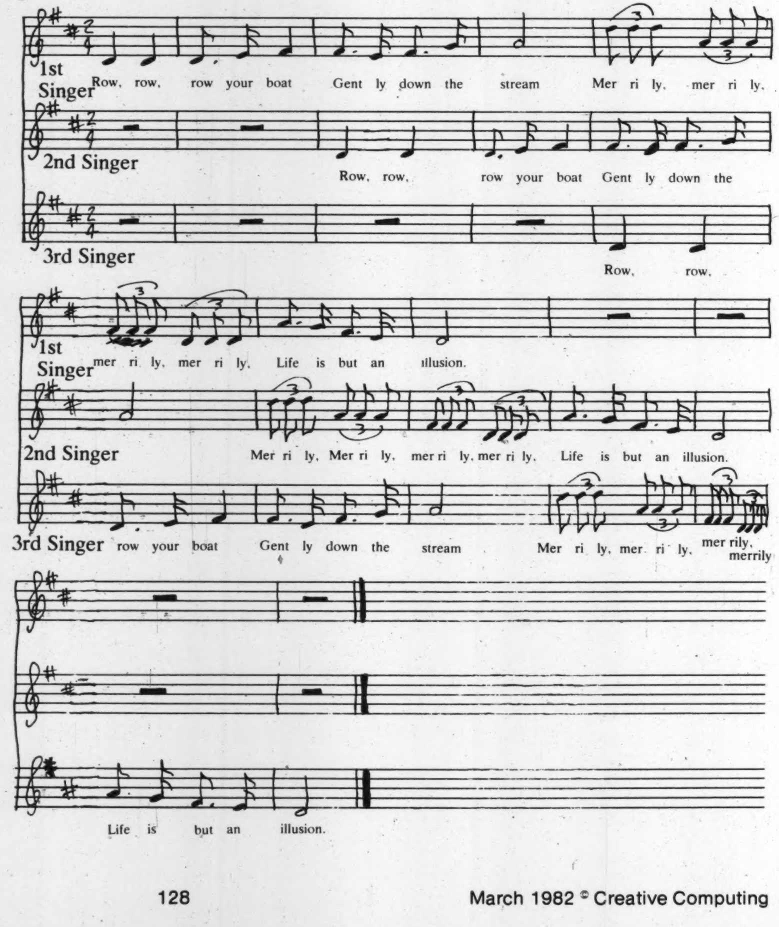

Row, row, row your boat Gent ly down the stream
Mer ri ly, mer ri ly, mer ri ly, mer ri ly, Life is but an illusion.

Figure 6.


1st Singer
Row, row, row your boat Gent ly down the stream Mer ri ly, mer ri ly,
2nd Singer
Row, row, row your boat Gent ly down the
3rd Singer
Row, row,
1st Singer
mer ri ly, mer ri ly, Life is but an illusion.
2nd Singer
Mer ri ly, Mer ri ly, mer ri ly, mer ri ly, Life is but an illusion.
3rd Singer
row your boat Gent ly down the stream Mer ri ly, mer ri ly, mer rily, merrily
Life is but an illusion.

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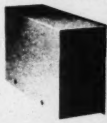

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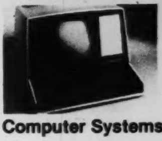

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(and from any part) whenever the sound is needed. Also, if the sound doesn't come out as the musician imagined it, changing the subroutine sound commands will change the playback sound all through the song (without the musician having to find and change the commands everywhere the sound was needed in the song).

Some musicians have even programmed rapid note sequences (with many sound changes) which have a total duration equal to, say, an eighth note. They then call this subroutine once for an eighth note, twice for a quarter note, and so forth; and select the "pitch" of the complex sound by setting different transposition values before each call. Using this technique, it is necessary to specify note durations shorter than most music languages allow.

Many songs lend themselves to complicated subroutine arrangements. For example, the popular Christmas song "The Twelve Days of Christmas" has a theme which plays one in the first verse, twice in the second, three times in the fourth, and so on. The sixth through twelfth themes are all the same. Figure 7 shows the subroutines used.

Figure 7.

```
SUB 1: (sound settings for first theme), (notes for first theme)
SUB 2: (sound settings for second theme), (notes for second theme), CALL SUB
1
SUB 3: (sound settings for third theme), (notes for third theme), CALL SUB 1
SUB 4: (sound settings for fourth theme), (notes for fourth theme), CALL SUB 1
SUB 5: (sound settings for fifth theme), (notes for fifth theme), CALL SUB 4
SUB 6: (sound settings for sixth theme), CALL SUB 13, CALL SUB 5
SUB 7: (sound settings for seventh theme), CALL SUB 13, CALL SUB 6
SUB n: (sound settings for nth theme), CALL SUB 13, CALL SUB n-1
SUB 12: (sound settings for twelfth theme), CALL SUB 13, CALL SUB 11
SUB 13: (notes for the usual theme)
SUB 14: (notes for the first part of the song)
```

Notice that the notes for the first part of the song, which are played before each set of themes, are programmed into SUB 14, the notes of the usual theme which is played for the sixth through twelfth verses are programmed into SUB 13, and the notes of the first through fifth verses are programmed sort of "in place" in SUB 1 through SUB 5. Now, to play the song, the part should contain:

CALL SUB 14, CALL SUB 1, CALL SUB 14, CALL SUB 2, CALL SUB 14, CALL SUB 3, CALL SUB 14, CALL SUB 4, CALL SUB 14, CALL SUB 5, CALL SUB 14, CALL SUB 6, CALL SUB 14, CALL SUB 7, CALL SUB 14, CALL SUB 8, CALL SUB 14, CALL SUB 9, CALL SUB 14, CALL SUB 10, CALL SUB 14, CALL SUB 11, CALL SUB 14, CALL SUB 12.

Each "CALL SUB 14" plays the melody that precedes the one-to-twelve repetitions of the theme, and the other calls (SUB 1 through SUB 12) play the theme one to twelve times. The calls become rather complicated. For example, on the sixth verse, SUB 6 is called which calls SUB 13. SUB 13 plays the sixth theme, then returns to SUB 6 which calls SUB 5. SUB 5 plays the fifth theme, then calls SUB 4. SUB 4 plays the fourth theme, then calls SUB 3. SUB 3 plays the third theme, then calls SUB 2. SUB 2 plays the second theme, then calls SUB 1. SUB 1 plays theme 1, then (since it has no more commands to execute) returns to SUB 2. SUB 2 then returns to SUB 3, which returns to SUB 4, which returns to SUB 5 which returns to SUB 6. SUB 6 has no further commands, so it returns to the part that originally did the CALL SUB 6. As most programmers already know, these are called "nested subroutines."

Most languages have a limit on the number of nested subroutines (commonly called the "nesting depth" limit), and Basics often have a maximum depth of nine or ten. So, a sophisticated music system must be designed for a greater nesting depth than is usual for languages if it is to handle something like a CALL SUB 12 from the previous example.

> ***Music synthesizers are not particularly good at simulating the sound of conventional instruments.***

Incidentally, you will notice that each subroutine in the one through twelve series began with a sound setting. This lets each of the twelve verses play with a different sound to add variety (and to let the listener figure out which verse is playing when no one is singing along). You can see now how important it is to be able to change the sound at any point in the musical score—songs would be pretty dull with only one sound per part.

I have been saying "sounds" because there are many different ways that music synthesizers use to create different timbres. In conventional music, each different "sound" would actually be a different instrument; to make a sound change the composer would simply have one performer stop playing and another (playing a different instrument) begin, or perhaps have a performer who has been playing softly begin to play louder while another performer begins to play softer.

Despite advertising claims you may have read, music synthesizers are not particularly good at simulating the sound of conventional instruments (although some very expensive synthesizers do come very close to simulating a small number of different instruments). However, you can reasonably expect them to produce a variety of different sounds, and to have sounds that fit the mood of the song. Some sounds will be very familiar and make most people think of a particular conventional instrument (although anyone who has played that instrument will be quick to point out the differences in the sound); other sounds will be familiar but not easily defined, and, of course, some sounds will be unique to the music synthesizer itself.

Some synthesizers have a wider variety of sounds than others, although since such different techniques are used it is difficult to compare all the available models. But if the model you pick is a little limited, you can rely on subroutines to help you expand the sound possibilities (if subroutines are available and operate in the manner I am about to describe). And if your synthesizer already has a good range, you'll be able to expand that range even more!

The first technique is the pseudo frequency shift. Let's say you are using a simple "ping" (attack-decay) type envelope, where each note gets loud rapidly and then dies away (rather like a plucked string). You begin by programming what would

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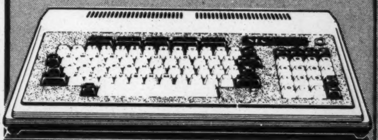

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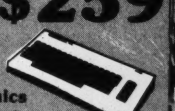

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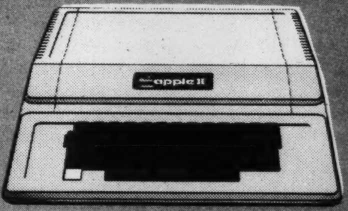

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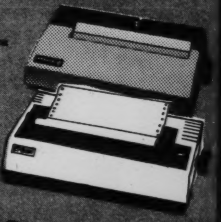

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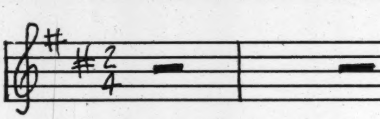
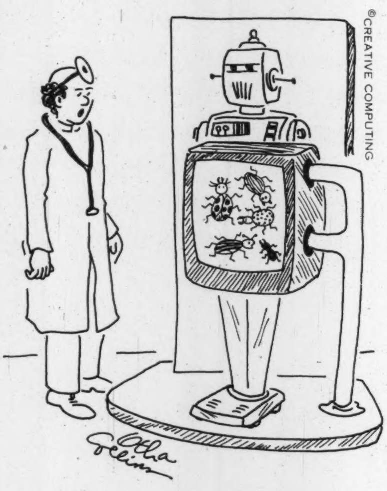
Musical Subroutines, continued...

normally be part 1, for example, as subroutine 1. Now program part 1 as CALL SUB 1. This doesn't seem to gain you anything; so far, it is as if you had programmed everything in part 1 and not used any subroutines. Now, create a second part, and program in it a one octave transpose, a small rest. and a CALL SUB 1. Obviously, both parts are going to play exactly the same thing, except part 2 is going to play it a little later and one octave higher (or lower, as the case may be). By selecting the right duration for the small rest, you can get the two parts to reach the loudest point of each note one right after the other. When you listen, each note will seem to start at the normal pitch but end up one octave higher, since at first the normal frequency will be louder but then the transposed frequency will become louder. A third part with a different transpose and a longer rest can be added to create an additional "frequency shift." This assumes that your music language allows a subroutine to be called from several parts not in sync (which is the same as the "round" capability mentioned before), allows dynamic transposition that affects subroutine playback, and allows very short rests.

> **Subroutines are mostly a way to reduce repetitious entry and to reduce the amount of memory required to represent a musical score.**





"You'll be fine once we get the bugs out."

Even if the music language you are using doesn't allow transposition during playback, you can still use the above technique to good advantage if your system has stereo. Simply by having part 1 be on the left and part 2 on the right, each note will seem to move from left to right. An "echo" or "reverb" effect is also provided. In fact, even if you don't have stereo you can create an echo effect just with round-type subroutines and very short rests.

You may have read articles about "additive synthesis" where several "harmonics" or "partials" are added together to create a complex sound. You may not have realized that subroutines can be used to endow any multi-channel (or multi-voice) music card with a form of additive synthesis. You begin by programming what would normally be an entire part into a subroutine, just like the frequency shift scheme just described, and call that subroutine from several parts. Now just select different sounds on each part, and (since each part is playing the same melody) the various sounds playing at once will be added together—"additive synthesis."

Short rests can be used in some parts if you wish to increase the reverb or large room feeling. Usually, each part will have a fairly similar sound; often the sound of each voice is identical except that each voice uses a different envelope rate or shape (or some other simple change). A dynamic transpose is particularly useful here since additive synthesis is usually done by adding different frequencies together. It takes a little bit of experimenting to get a sound to work out well, which is why I have explained the frequency shift example above.

Subroutines are mostly a way to reduce repetitious entry and to reduce the amount of memory required to represent a musical score. If you don't mind entering the same notes over and over again, and if your computer has infinite memory, you may be able to do all the things I have mentioned here without using subroutines. Unfortunately the music systems which are advanced enough to have subroutines are usually the ones that are carefully written to pack the most music in the smallest amount of memory as well.

So if you happen to be writing your own music language, or perhaps purchasing an available one, you'll want to keep these subroutine uses in mind. And if you've found any new uses for musical subroutines, write me a note. I've got a feeling we're just beginning to scratch the surface! ☐

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CIRCLE 219 ON READER SERVICE CARD

Celestial Music

Leo Christopherson

In my most recent programs, Duel-N-Droids and Voyage of the Valkyrie, I have used a musical sound effect which has attracted a great deal of attention. I call it a "celeste" sound. This article will show you how to use the musical sound effect in your own programs on the TRS-80, Models I or III, on the Apple II Plus, and on the Atari.

Before learning the details, you might be interested in hearing how this technique came about.

In the Beginning...

In the beginning, there was the TRS-80 Model I (at least that's where I started). This machine seemed to be unable to output sound effects. But then, along came the tape output, machine level routines, and string packing, which combined to provide a way to create sound effects. These ideas led to "one-note-at-a-time" music. I'll call this first musical routine, "Number One." But, I found myself wishing to be able to output two (or more) music notes simultaneously. In other words, I wanted at least two-part harmony.

The first musical routine begat a second. Number Two was really just the first one used twice. The routine sent out one note followed immediately by another, and then repeated this several times to give the notes duration. Depending on how the timing loops were set, the sound varied from a warbling, up and down kind of thing, to the effect of a base (fundamental) note with an overtone.

```
 5 CLS: PRINT "CELESTE MUSIC DEMO"
10 S$="............(70 PERIODS IN THIS LINE)..............."
11 S1=PEEK(VARPTR(S$)+1): S2=PEEK(VARPTR(S$)+2): S0=S1+S2*256
12 POKE 16422,S1: POKE 16423,S2
20 A$="............(52 PERIODS IN THIS LINE)..............."
21 A1=PEEK(VARPTR(A$)+1): A2=PEEK(VARPTR(A$)+2): A0=A1+A2*256
25 GOSUB 60
30 POKE S0+1,A1: POKE S0+2,A2: LPRINT: STOP
50 DATA 33,1,1,243,62,1,8,62,35,61,190,32,2,251
51 DATA 201,126,35,86,94,29,14,10,6,225,21,32,14,87
52 DATA 62,120,190,40,6,8,238,3,211,255,8,122,86,29
53 DATA 32,15,95,62,120,190,40,6,8,238,3,211,255,8
54 DATA 123,94,29,16,219,13,32,214,61,32,209,35,24,193
55 DATA 32,149,32,74,16,79,8,99,8,88,16,79,12,74,4,120
56 DATA 32,149,32,88,48,99,16,120,32,177,32,111,16,118
57 DATA 8,149,8,133,16,118,12,111,4,120,16,133,8,158
58 DATA 8,149,16,133,16,118,64,149
60 RESTORE: FOR N=0TO69: READ D: POKE S0+N,D: NEXT N
65 FOR N=0TO51: READ D: POKE A0+N,D: NEXT N: RETURN
```

Celeste Program for the TRS-80, Models I and III.

Leo Christopherson, 179 East 129th, Tacoma, WA 98445.

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CIRCLE 237 ON READER SERVICE CARD

```
10 HOME: PRINT "CELESTE MUSIC DEMO"
15 DATA 1,............(81 PERIODS IN THIS LINE).............
20 DATA 2,............(53 PERIODS IN THIS LINE).............
25 RESTORE: READ D$: S1=PEEK(125): S2=PEEK(126): S0=S1+S2*256+1
30 READ D$: READ D$: A1=PEEK(125): A2=PEEK(126): A0=A1+A2*256+1
35 READ D$: GOSUB 70
40 POKE 250,A1: POKE 251,A2: CALL S0: STOP
50 DATA 169,1,133,249,164,249,177,250,201,255,208
51 DATA 1,96,133,252,200,177,250,133,253,166,253
52 DATA 164,253,136,169,32,133,254,169,255,133,255,202
53 DATA 208,11,165,253,201,100,240,3,173,48,192,166,253
54 DATA 136,208,12,165,253,201,100,240,3,173,48,192,164
55 DATA 253,136,198,255,208,223,198,254,208,215,198,252
56 DATA 208,207,230,249,230,249,24,144,179
57 DATA 16,215,16,107,8,113,4,143,4,127,8,113,6,107,2
58 DATA 100,16,215,16,127,24,143,8,100,16,254,16,161,8,171
59 DATA 4,215,4,192,8,171,6,161,2,100,8,192,4,229
60 DATA 4,215,8,192,8,171,32,215,255
70 FOR N=0TO80: READ D: POKE S0+N,D: NEXT N
75 FOR N=0TO52: READ D: POKE A0+N,D: NEXT N: RETURN
```

Celeste Program for the Apple, using Applesoft Basic.

Number Two begat Number Three. It used three Number Ones, end to end. The useful result was to give the effect of a base note with two overtones. These three music routines, Numbers One, Two, and Three have been used in most of my programs.

But, I still didn't have the two-part harmony I wanted.

And so it came to pass that Number Three begat Number Four. And Number Four begat Number five...and Number Twelve begat Number Thirteen. After this many generations, many mutations had crept in, however. Most of these monsters were laid to rest immediately after birth.

Ah, but behold Lucky Number Thirteen. It did not produce a base note with twelve overtones. I had finally created a routine which would output two notes simultaneously.

Number Thirteen ties the two pitch delay loops together with a couple of duration delay loops. It works. But, as is true with many offspring, my Number Thirteen has one major flaw in its character. In the case of Thirteen, under most circumstances, it sounds absolutely awful!

Square waves do not add together well. I found that combining two pitches, such as a "C" and an "E," would produce a myriad of overtones which clashed. But, the most serious problem resulted from beats between the fundamentals of the two notes. The beat frequency was often a note lower in pitch than either of the two original notes. It was also usually not in harmony with them. It was also very loud.

Celeste Program for the Atari.

```
10   PRINT "<ESC><CTRL><CLEAR> CELESTE MUSIC DEMO"
50   DATA 16,121,16,60,8,64,4,81,4,72
51   DATA 8,64,6,60,2,100,16,121,16,72
52   DATA 24,81,8,100,16,144,16,91,8,96
53   DATA 4,121,4,108,8,96,6,91,2,100
54   DATA 8,108,4,128,4,121,8,108,8,96
55   DATA 32,121,255
60   RESTORE
65   DISTORTION = 10: READ DURATION
70   IF DURATION = 255 THEN 110
75   READ PITCH
80   IF PITCH = 100 THEN DISTORTION = 1
85   SOUND 0, PITCH, DISTORTION, 10
90   SOUND 1, PITCH-1, DISTORTION, 5
95   FOR DELAY = 0 TO DURATION * 40
100  NEXT DELAY
105  GOTO 65
110  SOUND 0, 0, 0, 0: SOUND 1, 0, 0, 0
115  STOP
```

TRS-80 Celeste Music Scales.

Octave One			Ocatve Two			Octave Three		
Note	Decimal	Hex	Note	Decimal	Hex	Note	Decimal	Hex
Eb	251	FE	Eb	125	7D	Eb	62	3E
E	238	EE	E	118	76	E	59	3B
F	225	E1	F	111	6F	F	55	37
Gb	211	D3	Gb	105	69	Gb	52	34
G	199	C7	G	99	63	G	49	31
Ab	188	BC	Ab	93	5D	....		
A	177	B1	A	88	58			
Bb	168	A8	Bb	83	53	Rest =	120	78
B	158	9E	B	79	4F			
C	149	95	C	74	4A			
Db	141	8D	Db	70	46			
D	133	85	D	66	42			
....			....					

ALF Music Synthesizer

The ALF Apple Music Synthesizer (AMS) is an easy to use peripheral which allows you to program music into an Apple II computer using standard musical notation. The ALF kit includes the synthesizer board (plugs into any peripheral slot), exceptional quality software, and an extensive user manual.

Sophisticated Music Entry Program

Sheet music is easily entered using the Apple game paddles. The high-resolution ENTRY program features the familiar music staff with a "menu" of musical items listed beneath it (note lengths, rests, edit commands, accidentals, etc.). One game paddle moves a cursor up and down the music staff and is used to select the note pitch; the second paddle chooses from the menu items (note length, etc.) With the ALF hi-res ENTRY program, you won't have to use cryptic codes to select note parameters.

As you program sheet music with ENTRY, measure bars are inserted automatically (and note values are tied over the bar where necessary). Key signatures are also automatic—you don't have to keep writing in every sharp or flat!

Three monophonic, individual parts can be programmed with each ALF Music Synthesizer. Two boards are required for stereo. A total of three synthesizers can be used simultaneously for a maximum of nine voices. By controling the envelope (or shape) of each voice, many different instrumental sounds can be simulated.

Eight-octave Range

The ALF Music Synthesizer has a pitch range of eight octaves—a wider range than a grand piano. The ALF can also play semitones—"blues notes" or the pitches in between the keyboard notes of a piano. (The pitch range is from 27.5 to 55,000 Hertz, well beyond the limits of human hearing.) Tuning accurancy is virtually perfect within two cents of pitch value.

Every parameter of the ENTRY program can be changed again and again during a musical piece. For example, you can make changes in key, time signature, volume, and timbre (envelope). Parts can be edited at any time, also. Notes can be added or deleted, note length can be changed, as well as pitch, volume, etc.

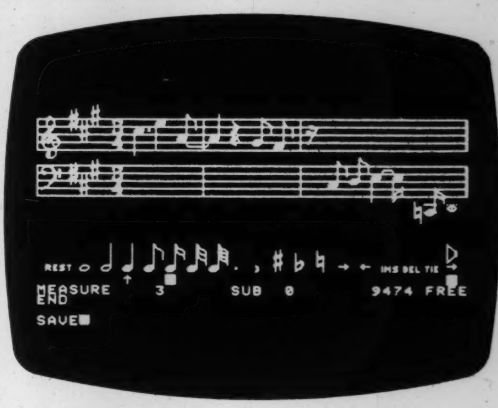
You can save songs on either cassette or disk, and play them back using either ENTRY or PLAY. The playback speed is adjusted with one of the game paddles, and can be varied during the playback, if you wish to change the overall tempo.

Colorful Playback Display

The ALF Music Synthesizer features a 16-color low-res graphic display during song playback. Each musical part is represented on a stylized piano "keyboard"—the intensity of the note determines the color, and the pitch is shown in relation to "middle C".

The ALF Music Synthesizer requires the use of an external audio amplifier. Stereo programming is possible with the use of two or three synthesizer boards.

The ALF software includes the ENTRY and PLAY programs, sample songs, an introduction to "envelope shaping", and demonstrations of advanced uses of the synthesizer.



With the ALF software, entry of music is easy, fast and accurate.

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The AM-II has **stereo output** (3 voices in left, 3 voices in the middle, 3 voices in the right).

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The AM-II is manufactured with the same high quality standards as other products from the ALF Corporation. No sacrifice has been made in reliability; the new AM-II is simply a great bargain.

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Octave One			Ocatve Two			Octave Three		
Note	Decimal	Hex	Note	Decimal	Hex	Note	Decimal	Hex
A	254	FE	A	127	7F	A	63	3F
Bb	241	F1	Bb	120	8	Bb	60	3C
B	229	E5	B	113	71	B	56	38
C	215	D7	C	107	6B	C	53	35
Db	203	CB	Db	101	65	Db	50	32
D	192	C0	D	95	5F	D	47	2F
Eb	181	B5	Eb	90	5A	Eb	44	2C
E	171	AB	E	85	55	E	42	2A
F	161	A1	F	80	50	....		
Gb	151	97	Gb	75	4B			
G	143	8F	G	71	47	Rest =	100	64
Ab	135	87	Ab	67	43			
....			....			Data End =	255	FF

Apple Celeste Music Scales.

TRS-80 Celeste Music Data, (Decimal Values).

Note#	Duration	Pitch		Note#	Duration	Pitch	
1	32	149	C	14	32	111	F
2	32	74	C	15	16	118	E
3	16	79	B	16	8	149	C
4	8	99	G	17	8	133	D
5	8	88	A	18	16	118	E
6	16	79	B	19	12	111	F
7	12	74	C	20	4	120	Rest
8	4	120	Rest	21	16	133	D
9	32	149	C	22	8	158	B
10	32	88	A	23	8	149	C
11	48	99	G	24	16	133	D
12	16	120	Rest	25	16	118	E
13	32	177	A	26	64	149	C

There was only one combination of pitches that actually did sound very good. That occurred when the frequency of the one note was almost the same as that of the other. This is the "celeste" sound.

I think the name, celeste, comes from the pipe organ people. Organs often have a stop consisting of two ranks of pipes that are slightly out of tune with each other. It's called a celeste stop (from the word "celestial"), because it gives a very sweet and heavenly sound as the two frequencies slowly beat with each other. The mandolin produces this sort of sweet sound by using two strings at each pitch.

But, now let's get down to earth about this whole celestial business. As you're exorcizing those devilish little bugs from your next program, you may want to add a little heavenly music to soothe the savage beast.

The Word For TRS-80 and Apple Users

To get the celeste music routine working, all you have to do is type in and RUN the Basic program for your machine. Of course, every number of each DATA line has to be correct! We're dealing with machine level here, and once your program has jumped into the routine, the usual Basic error traps probably will not work. You may lose the whole program. I strongly suggest that the program be SAVEd before it is RUN.

The TRS-80 program uses string packing, while the Apple program uses DATA packing. These techniques allow the machine level routines to be saved as part of the Basic program. There doesn't need to be a separate machine level load. This can be important for tape users, for whom loading a separate binary program can be a pain.

The TRS-80 program uses VARPTR to find the absolute memory addresses of the music routine and the musical data.

The Apple program uses DATA, READ, and RESTORE to find the absolute memory addresses for the machine level material. It makes use of zero page addresses 125 and 126. These addresses contain the low and high bytes of the absolute address of the next DATA which will be read.

TRS-80 people will need to connect an amplifier to the tape AUX out plug.

Once the program is running correctly, TRS-80 programmers may DELETE line 25 and lines 50-65 and then SAVE the program again. After the first time through, lines 10 and 20 have been packed and there is no need to pack them again.

Apple programmers may DEL line 35, and then DEL lines 50 and 75. Do this after the program has been tested and

"As every thread of gold is valuable, so is every minute of time."

Mason

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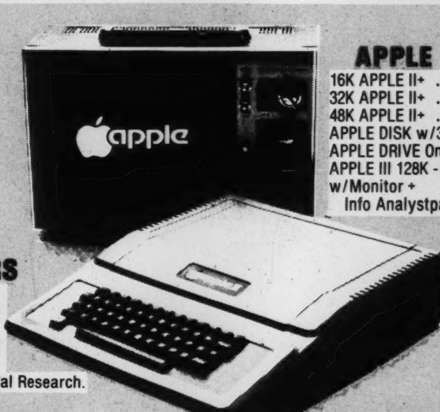

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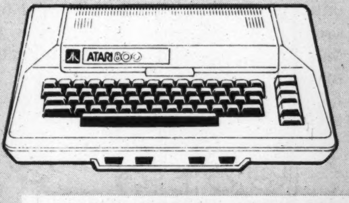

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Note#	Duration	Pitch		Note#	Duration	Pitch	
1	16	215	C	14	16	161	F
2	16	107	C	15	8	171	E
3	8	113	B	16	4	215	C
4	4	143	G	17	4	192	D
5	4	127	A	18	8	171	E
6	8	113	B	19	6	161	F
7	6	107	C	20	2	100	Rest
8	2	100	Rest	21	8	192	D
9	16	215	C	22	4	229	B
10	16	127	A	23	4	215	C
11	24	143	G	24	8	192	D
12	8	100	Rest	25	8	171	E
13	16	254	A	26	32	215	C
				27	255	(End Byte)	

Apple Celeste Music Data, (Decimal Values).

Atari Celeste Music Data, (Decimal Values).

Note#	Duration	Pitch		Note#	Duration	Pitch	
1	16	121	C	14	16	91	F
2	16	60	C	15	8	96	E
3	8	64	B	16	4	121	C
4	4	81	G	17	4	108	D
5	4	72	A	18	8	96	E
6	8	64	B	19	6	91	F
7	6	60	C	20	2	100	Rest
8	2	100	Rest	21	8	108	D
9	16	121	C	22	4	128	B
10	16	72	A	23	4	121	C
11	24	81	G	24	8	108	D
12	8	100	Rest	25	8	96	E
13	16	144	A	26	32	121	C
				27	255	(End Byte)	

found to be OK, then SAVE it again. Once DATA lines 15 and 20 are packed, there is no need to pack them again.

The Word For Atari Users

You Atari people are indeed the fortunate folk in this case. Since you can output up to four simultaneous musical notes directly from Basic, the celeste effect, using two notes, is quite easy to achieve. Just enter and RUN the Basic program for your machine to hear the celeste sounds.

Dancing To A Different Tune

It is likely that you will now want to try out a tune of your own choosing. The following instructions will help you create your own celestial music.

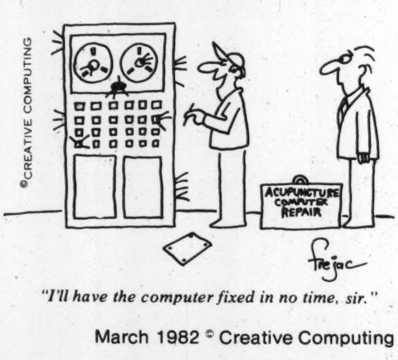
The music data for all three machines consists of a series of two-byte groups. The first byte of the pair is the duration of the note, and the second byte is the pitch of the note. Apple and TRS-80 programmers may use only about 120 of these note pairs since the notes are packed into Basic lines which have a maximum length of 255 bytes. The Atari programmer is limited only by the size of the memory in his machine.

To change the music data, you must first refer to the table of Celeste Music Scales for your machine. Using this table, you must write out pairs of bytes for each note of your music: the first byte is the duration and the second is the pitch from the table. Atari owners should use the table of pitches provided in the Basic Reference Manual which came with the machine. Programmers may also wish to refer to the table showing the Celeste Music Data from the original program.

All three versions use an "end byte" to tell the routine that the music is done. On the TRS-80, the quotation mark at the end of A$ is used. For the Apple and the Atari, a single byte of 255 must be placed at the end of your data pairs.

TRS-80

The data you have prepared must now be packed into line 20. Count how many separate items of data you have and then enter a new line 20 with A$ equal to a series of periods equal in number to the data count. Enclose the periods in quotation marks.



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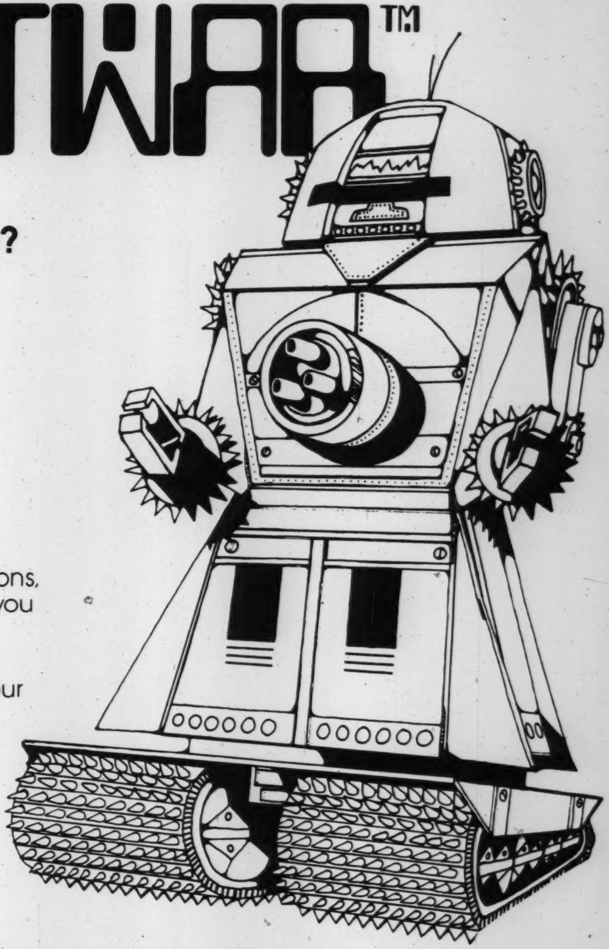

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CIRCLE 225 ON READER SERVICE CARD

Step#	Decimal	Hex	Statement
0	33	21	LDHL,NN
1	1	01	N
2	1	01	N
3	243	F3	DI
4	62	3E	LDA,N
5	1	01	N
6	8	08	EXAF,AF'
7	62	3E	LDA,N
8	35	23	N
9	61	3D	DEC,A
10	190	BE	CP,(HL)
11	32	20	JRNZ
12	2	02	e
13	251	FB	EI
14	201	C9	RET
15	126	7E	LDA,(HL)
16	35	23	INC,HL
17	86	56	LDD,(HL)
18	94	5E	LDE,(HL)
19	29	1D	DEC,E
20	14	0E	LDC,N
21	10	0A	N
22	6	06	LDB,N
23	255	FF	N
24	21	15	DEC,D
25	32	20	JRNZ
26	14	0E	e
27	87	57	LDD,A
28	62	3E	LDA,N
29	120	78	N
30	190	BE	CP,(HL)
31	40	28	JRZ
32	6	06	e
33	8	08	EXAF,AF'
34	238	EE	XOR,N
35	3	03	N
36	211	D3	OUT(N),A
37	255	FF	N
38	8	08	EXAF,AF'
39	122	7A	LDA,D
40	86	56	LDD,(HL)
41	29	1D	DEC,D
42	32	20	JRNZ
43	15	0F	e
44	95	5F	LDE,A
45	62	3E	LDA,N
46	120	78	N
47	190	BE	CP,(HL)
48	40	28	JRZ
49	6	06	e
50	8	08	EXAF,AF'
51	238	EE	XOR,N
52	3	03	N
53	211	D3	OUT(N),A
54	255	FF	N
55	8	08	EXAF,AF'
56	123	7B	LDA,E
57	94	5E	LDE,(HL)
58	29	1D	DEC,E
59	16	10	DJNZ
60	219	DB	e
61	13	0D	DEC,C
62	32	20	JRNZ
63	214	D6	e
64	61	3D	DEC,A
65	32	20	JRNZ
66	209	D1	e
67	35	23	INC,HL
68	24	18	JR
69	193	C1	e

TRS-80/Z-80 Celeste Music Subroutine.

Step#	Decimal	Hex	Statement
0	169	A9	LDA
1	1	01	01
2	133	85	STA
3	249	F9	F9
4	164	A4	LDY
5	249	F9	F9
6	177	B1	LDA,Y
7	250	FA	FA
8	201	C9	CMP
9	255	FF	FF
10	208	D0	BNE
11	1	01	e
12	96	60	RTS
13	133	85	STA
14	252	FC	FC
15	200	C8	INY
16	177	B1	LDA,Y
17	250	FA	FA
18	133	85	STA
19	253	FD	FD
20	166	A6	LDX
21	253	FD	FD
22	164	A4	LDY
23	253	FD	FD
24	136	88	DEY
25	169	A9	LDA
26	32	20	20
27	133	85	STA
28	254	FE	FE
29	169	A9	LDA
30	255	FF	FF
31	133	85	STA
32	255	FF	FF
33	202	CA	DEX
34	208	D0	BNE
35	11	0B	e
36	165	A5	LDA
37	253	FD	FD
38	201	C9	CMP
39	100	64	64
40	240	F0	BEQ
41	3	03	e
42	173	AD	LDA
43	48	30	30
44	192	C0	C0
45	166	A6	LDX
46	253	FD	FD
47	136	88	DEY
48	208	D0	BNE
49	12	0C	e
50	165	A5	LDA
51	253	FD	FD
52	201	C0	CMP
53	100	64	64
54	240	F0	BEQ
55	3	03	e
56	173	AD	LDA
57	48	30	30
58	192	C0	C0
59	164	A4	LDY
60	253	FD	FD
61	136	88	DEY
62	198	C6	DEC
63	255	FF	FF
64	208	D0	BNE
65	223	DF	e
66	198	C6	DEC
67	254	FE	FE
68	208	D0	BNE
69	215	D7	e
70	198	C6	DEC
71	252	FC	FC
72	208	D0	BNE
73	207	CF	e
74	230	E6	INC
75	249	F9	F9
76	230	E6	INC
77	249	F9	F9
78	24	18	CLC
79	144	90	BCC
80	179	B3	e

Apple/6502 Celeste Music Subroutine.

If you haven't DELETEd lines 50-65 yet, do so now. Have line 25 as shown in the original program. Put your new data into DATA lines from 50 to 59. Then add a line 60 as follows:

60 FOR N=0TOX: READ D: POKE A0+N,D: NEXT N: RETURN

The "X" is to be replaced by a number which is one less than your data count. When you RUN the program, you should hear your new musical data played. If all is well, you may DELETE line 25 and lines 50-60.

Apple

We must now pack line 20 with your new music data. Count the number of items of data you have, including the "end byte." Retype line 20 as follows:

20 DATA 2,....(number of periods is same as data count)....

If you haven't deleted lines 50 through 75, do so now. Have line 35 as shown in the original program. Put your new data into DATA lines from 50 to 69. Then type a line 70 to read:

70 FOR N=0TOX: READ D: POKE A0+N,D: NEXT N: RETURN

The "X" is to be replaced by the number you get by subtracting one from your data count. When you RUN the program, you should hear your new musical selection. You may now wish to delete line 35 and the lines from 50 through 70.

Atari

The data lines 50 to 55 are the music data. Just replace these lines with your new data and run the program to hear the new music you've made. A table of the original Celeste Music Data is included as an example.

...The Last Words

I have included the machine code listings for the Z-80 and 6502 celeste music subroutines. You more ambitious programmers may want to go through them and modify and improve upon them to suit your own purposes. You may find an especially valuable pot of gold somewhere over your own rainbow! ☐

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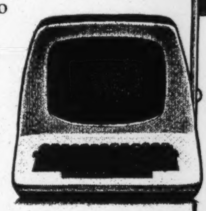

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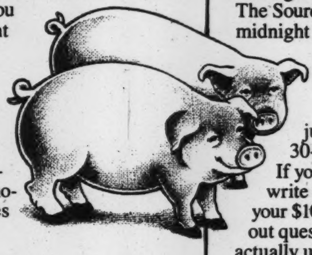

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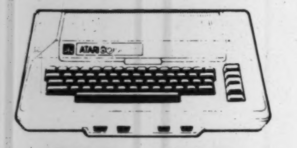

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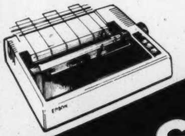

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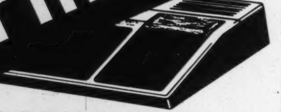

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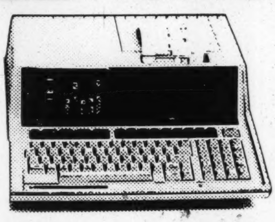

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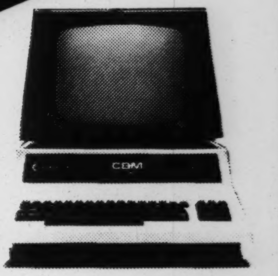

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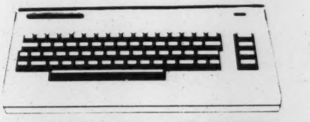

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In-Pro-Physe: Interactive Programming For The Physically Limited

Russel W. Van Norman, M.D.

I have always wanted to play with a computer. A summer course in Fortran at our local university only whetted my appetite. Then home computers became available. This gave me a chance to learn about machine language for the 8080 central processing unit on a single board Computer-in-a-Book. But still I had trouble justifying the expense of a real computer.

Avidly I pored over the computer magazines looking for reasons to spend money. A couple of runthroughs and most games bored me, so an expensive game player certainly was not my thing. My wife seldom used recipes and hardly ever needs to know how to cut a recipe for one hundred down to a meal for six, so that justification was out, too.

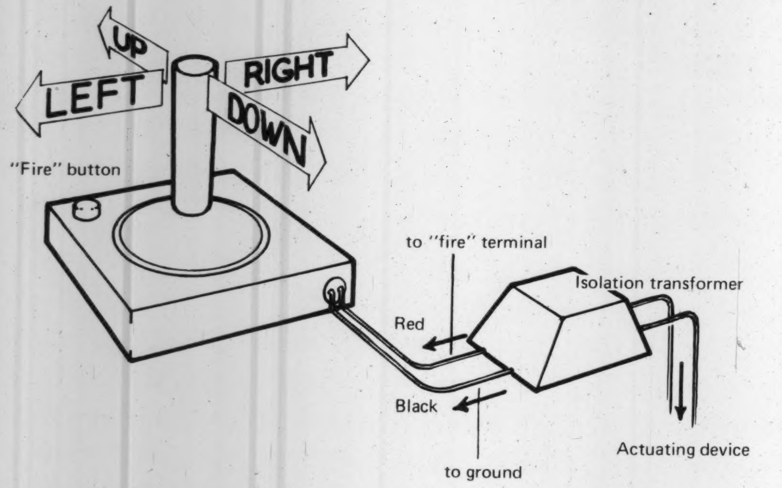

Figure 1. A standard Atari Joystick has had the "fire" button disconnected and the leads connected to an isolation transformer to electrically isolate the user.

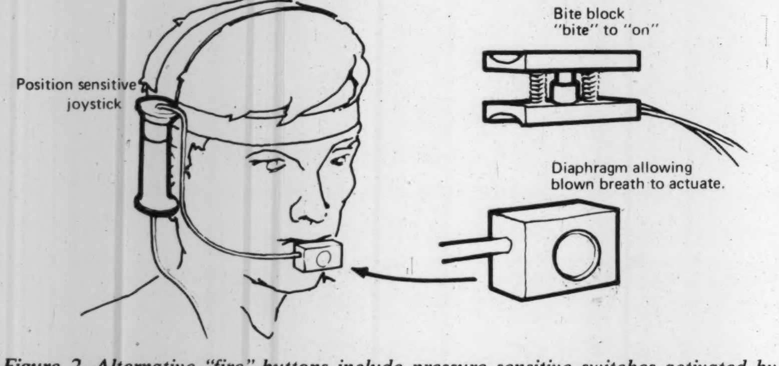

Figure 2. Alternative "fire" buttons include pressure sensitive switches activated by blown breath or bite. An alternative for keyboard control could be a position-sensitive joystick held by a head harness.

Then one day about two-and-a-half years ago, I stood beside the bed of a young man paralyzed from the neck down due to an auto accident—a young man who a year earlier had been a varsity football player on the team for which I was a doctor.

Having already operated so that his broken neck could not cause him further damage, I tried to find somthing more that I could do for him. And it hit me that the computer offered the means by which he could be independent of constant attention. He could control his surroundings and help himself, communicate and interreact with others, and he could enhance his own quality of life.

And there were others called handicapped who could be helped, too. People with poor use of their limbs—those with cerebral palsy or multiple sclerosis or other types of paralysis—would benefit by being able, at least in part, to set their own life style.

Having formed a tax exempt, charitable organization called Fulcrum Foundation, Inc., whose motto, borrowed for the handicapped, is "give me a lever and I'll move the world," several of us explored the means by which those unable to make the fine movements involved in typing on a computer terminal could effectively control and interact with these machines.

We found that there were two standard "interfaces" presently being used by people with poor extremity use. One approach is through software programs with progressing alphabets or word lists whose letters are chosen by pressing a switch as the proper selection becomes available. Other handicapped people use a rod secured to the head to push specially mounted keyboards.

Russel W. Van Norman, M.D., Associate Professor, Orthopaedic Surgery, Texas Tech University Health Sciences Center, Regional Academic Health Center at El Paso School of Medicine, 4800 Alberta Ave., El Paso, TX 79905.

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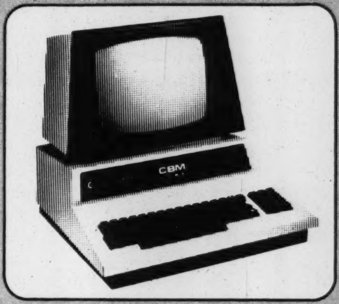

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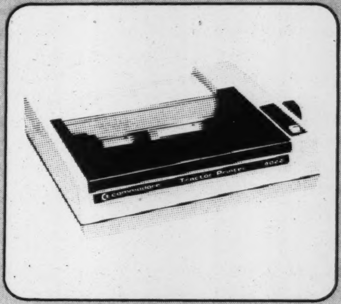

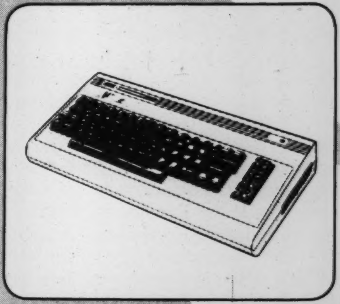

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Each of these ways is slowed by waiting for the proper selection to reach a certain screen position or limited by the speed of poking with the head rod.

This article presents another idea in a preliminary form upon which I hope others will expand. This interface and associated software gives the handicapped person more variety in actively selecting program purpose and allows a faster interaction.

A practical computer would require some portability and certainly a reasonable cost, so our choice was limited to the home sized machines. All those commercially available were considered before the Atari was chosen. Being a newer computer, available software programs are limited when compared with the Apple or the Radio Shack TRS-80. But to make a program available for use, any software would have to be modified to this proposed system.

It would be great if a user-modifiable cartridge, such as an erasable programmable read only memory (EPROM) device, could be developed for the Atari which could then contain permanently this control system and allow standard commercially available programs to be used. Well, that is for the future.

One particular advantage of the Atari is its two models which allow program development on the more expensive and versatile 800 but provide the handicapped person with the option of buying the less expensive 400 for use. Programming by keyboard would be a minimal activity for them, so the less responsive keyless keyboard of the 400 would not be a disadvantage.

The size of the program selection in any computer is limited by its storage device. In this case a cassette player is sufficient to load the 12K program in a reasonable length of time. By using multiple statements on one line and removing program explanations, it could be compacted further. A disk system would allow much more variety including adapted games. The Exatron Stringy Floppy, when available for the Atari, will offer an intriguing possibility of quick access to extensive storage without the expense or complications of a multiple disk system.

The principle in this scheme is applicable to all computers for which a joystick is available. My proposed interface (Figure 1) is a standard Atari joystick modified so that the red lead of the fire button and the black ground line are wired through a pressure actuated switch which could be secured to a wheelchair for operation by knee pressure or a chin control, fixed in a bite block to be actuated by jaw pressure, or terminated in a diaphragm switch tripped by blowing.

Separating the user from the computer by an isolation transformer would guard against the danger of electrical shock. The joystick could be modified by a strap or an extension, for example, to offer the user a better grip.

Another possibility is the new, position-sensitive Le Stick from Datasoft, Inc., a joystick which could be secured by a head harness and the firing trigger modified to a bit block or a breath-sensitive diaphragm (Figure 2).

Essential to the interface is a menu for selection of program choices and an on-screen keyboard. The joystick controls a cursor confined to the selection area. In each available subroutine a standard "escape" symbol (I use a diamond) would allow the user to return to the basic menu. Storage arrays can be provided in each so that the need to interrupt a program, for example to answer the telephone or turn on a light, will not destroy the project or game underway and it can be resumed after the interruption.

The software listing offers a selection menu suggesting telephone/modem and light control, and illustrates the ability to transmit a message by printing it on the screen rather than sending it to a printer. In actual use this subroutine would be designed for use with a particular printer.

A complete Message Preparation Program is included to allow writing a letter, report, or composition. A 1000-byte storage array retains the message for work or transmission until it is cleared for a new message.

Program Description

Initially, after loading the program and typing RUN, a menu of choices is presented (Figure 3). The numeral indicating the cursor position blinks. The joystick may be moved either forward or back to reposition the cursor. Left or right will not work. The cursor "wraps around" going from bottom to top, or top to bottom, so either direction is all right. Pushing the button makes the selection.

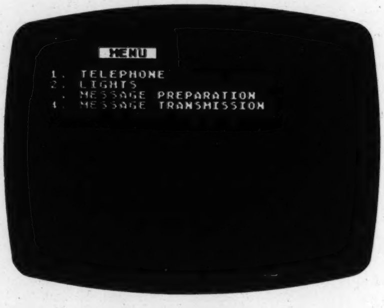

Figure 3. The menu offers four choices with the cursor position indicated by a blinking numeral (here, 3).

Telephone and light possibilities are indicated, but are left for future development. If selected, an "out of service" message is printed and the menu is again flashed on the screen. If Message Transmission is chosen no message will be displayed unless there is one in storage.

When Message Preparation is selected, the screen is cleared and a keyboard is printed on the bottom five lines of the screen (Figure 4). The keyboard cursor

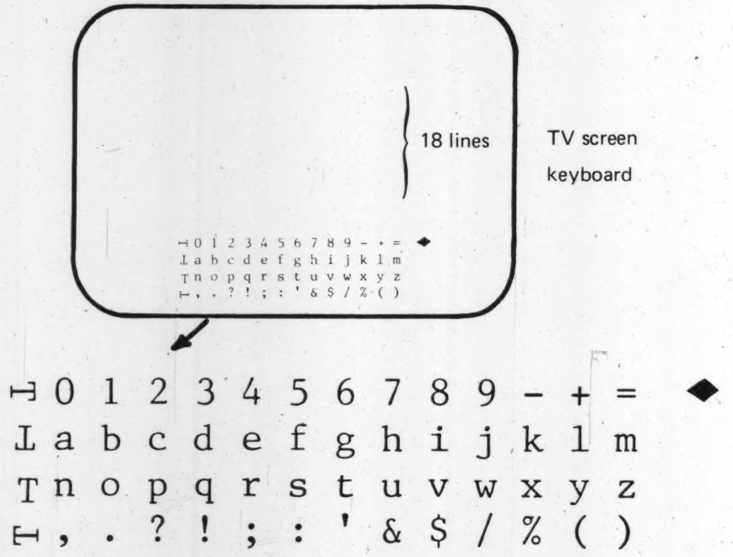

Figure 4. The on-screen keyboard occupying the lower five lines of the screen leaves 18 lines for message preparation.

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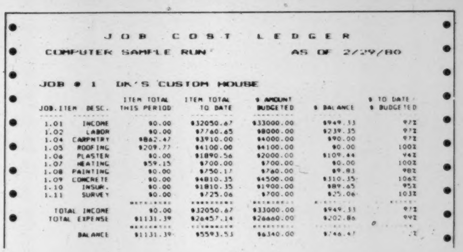

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                     J O B   C O S T   L E D G E R
 COMPUTER SAMPLE RUN                              AS OF 2/29/80

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                      ITEM TOTAL   ITEM TOTAL    $ AMOUNT                 $ TO DATE
JOB.ITEM   DESC.     THIS PERIOD     TO DATE     BUDGETED    $ BALANCE   $ BUDGETED
-----    --------    ----------   ----------   ----------   ---------   ---------
 1.01      INCOME         $0.00    $32050.67    $33000.00     $949.33         97%
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CIRCLE 176 ON READER SERVICE CARD

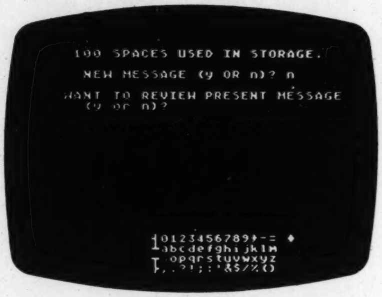
position again is indicated by the blinking letter. The top of the screen displays the number of spaces remaining in the 1000-space storage, and asks if the message to follow is a new one or a continuation of one underway. The keyboard cursor defaults to the "no" position to prevent accidental erasure of material being prepared (Figure 5). New parameters have been set for movement of the joystick allowing it to cover the keyboard.

If a message is being prepared, an opportunity is given to review either the entire stored message or only the last twenty bytes.

It takes about 15 seconds to prepare the storage area for a new message by filling it with blanks. This prevents extraneous characters from creeping in, and provides the blanks to fill out a line at the end of a paragraph.

When everything has been set up, movement of the joystick allows selection of the next character to be printed. Pressing the fire button causes the character to appear in the proper position on the eighteen lines available on the screen for the message. The nineteenth line of the message again begins at the top of the screen. After 975 characters have been stored, a warning is given, and when the message is 1000 characters long, the prompt to return to the menu and transmit the message is printed (Figure 6). Moving the keyboard cursor to the diamond automatically restores the menu to the screen.

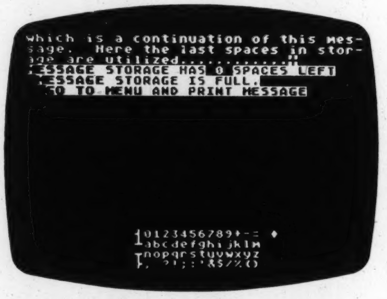
Several control characters are provided. The diamond is the "escape" allowing return to the menu at any time. Since I could find no arrows in the Atari character set, four "T's" oriented to the cardinal directions allow message editing. A properly oriented "T," that is, with the stem down, has two functions. The first push alerts the program to expect to skip the next line. The second push sends the cursor to the beginning of the next line without affecting the total character count in storage. This allows jumping forward after you have gone up a line or more to correct an error. Pressing any other key will move the cursor to the next line, place the intervening spaces in storage, and cause the program to print a character or prepare to print a capital letter.



```
100 SPACES USED IN STORAGE.
 NEW MESSAGE (y OR n)? n
WANT TO REVIEW PRESENT MESSAGE
  (y or n)?

0123456789+-= ◆
abcdefghijklm
opqrstuvwxyz
, .?!;:'&$/%()
```

Figure 5. Upon selection of Message Preparation, the number of spaces occupied in the Message Storage area is shown. The first question, whether a new message or not, is flashed. The keyboard cursor blinks at "n." If an old message, all or part of it may be reviewed.



```
which is a continuation of this mes-
sage.  Here the last spaces in stor-
age are utilized.............."
MESSAGE STORAGE HAS 0 SPACES LEFT
 MESSAGE STORAGE IS FULL.
  GO TO MENU AND PRINT MESSAGE

0123456789+-= ◆
abcdefghijklm
nopqrstuvwxyz
, ?!;:'&$/%()
```

Figure 6. When all spaces in the Message Storage Area have been used, a screen prompt prints. Moving the keyboard cursor to the diamond automatically clears the screen and returns the Menu.

```
1 REM ** MENU WITH MESSAGE GENERATION
2 REM
3 REM *** A FULCRUM FOUNDATION, INC. PROGRAM ***
4 REM * Russel W. Van Norman, M.D.
5 REM * EL PASO, TEXAS
6 REM REVISION OF JULY 4, 1981
7 REM
8 REM
10 MENU=100:WAIT=250:PST=280:CURSOR=400:CAP=470:DELAY=570:
   WIPE=600:SKIP=700:KEYBOARD=1600
20 DIM ANS$(1),M(1000),B$(40)
30 OPEN #3,4,0,"S:":PK=PEEK(83)-1:ND=PEEK(83)-6:TM=0
35 REM
40 REM ** ESTABLISH LINE BLANKER
50 FOR Z=1 TO 39:B$(Z)=" ":NEXT Z
55 REM
100 REM *** ENTIRE PROGRAM MENU ***
105 REM
110 GRAPHICS 0:POKE 752,1:CR=3:CRL=2:CL=1:CRR=2:CD=7:CDU=3:
    CU=2:CUD=6
120 POSITION 7,1:? " MENU "
130 POSITION 2,3:? "1. TELEPHONE"
140 POSITION 2,4:? "2. LIGHTS"
150 POSITION 2,5:? "3. MESSAGE PREPARATION"
160 POSITION 2,6:? "4. MESSAGE TRANSMISSION"
170 C=2:R=5
180 GOSUB PST
190 V=STRIG(0):IF V<>0 THEN 180
200 IF L=49 THEN 3000
210 IF L=50 THEN 5000
220 IF L=51 THEN 1000
230 IF L=52 THEN 2000
240 GOTO 180:REM * IGNORES OTHER INPUTS
245 REM
250 REM DELAY FOR VISUALIZING LETTER BLINK AND TO TURN OFF
    SOUND GENERATED BY CURSOR MOVE
260 FOR D=1 TO 10:NEXT D
270 SOUND 1,0,0,0:RETURN
275 REM
280 REM ** POSITIONS KEYBOARD CURSOR
290 U=STICK(0)
300 POSITION C,R
310 GET #3,L
320 POSITION C,R:? " ":GOSUB WAIT
330 POSITION C,R:? CHR$(L)
340 IF U<>15 THEN SOUND 1,INT(RND(0)*30)+L,10,8:GOSUB WAIT
350 IF U=7 THEN C=C+1:IF C=CR THEN C=CRL
360 IF U=11 THEN C=C-1:IF C=CL THEN C=CRR
370 IF U=13 THEN R=R+1:IF R=CD THEN R=CDU
380 IF U=14 THEN R=R-1:IF R=CU THEN R=CUD
390 RETURN
395 REM
400 REM ** POSITIONS MESSAGE CURSOR
410 POKE 77,0:X=X+1
```

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CIRCLE 153 ON READER SERVICE CARD

```
420 IF X=ND THEN ? "}"
430 IF X=PK THEN X=2:Y=Y+1
440 IF Y=18 THEN Y=0
450 IF X=2 THEN POSITION 0,Y:? B$
460 POSITION X,Y:? CHR$(147):RETURN
465 REM
470 REM ** REVERT ONE LINE OR CAPITAL
480 FOR TIME=1 TO 20:NEXT TIME
490 GOSUB PST
500 V=STRIG(0)
510 IF V<>0 THEN 490
520 IF L=24 THEN POSITION X,Y:? CHR$(M(N)):Y=Y-1:N=N-36:IF
    Y=-1 THEN Y=0:N=N+36
530 IF L=24 THEN POSITION X,Y:? CHR$(147):RETURN
540 L=L-32:REM * CONVERTS LETTER TO  CAPITAL
550 IF L<65 OR L>90 THEN GOTO 490
560 RETURN
565 REM
570 REM ** DELAY
580 FOR DL=1 TO 1000:NEXT DL:RETURN
585 REM
600 REM ** ERASES MESSAGE PART OF SCREEN
610 FOR Q=0 TO 17:POSITION 0,Q:? B$
620 NEXT Q:RETURN
625 REM
700 REM ** SKIP FOR SPACING
705 REM
710 FOR TIME=1 TO 20:NEXT TIME
720 GOSUB PST
730 V=STRIG(0)
740 IF V<>0 THEN 720
750 REM * NEXT LINE FROM EDIT
760 IF L=23 THEN POSITION X,Y:? CHR$(M(N)):N=N+36:Y=Y+1:IF
    Y=18 THEN Y=0
770 IF L=23 THEN POSITION X,Y:? CHR$(147):RETURN
780 REM * NEXT LINE FOR MESSAGE
790 POSITION X,Y:? CHR$(M(N)):N=N+PK-X:TM=TM+PK-X:X=2:Y=Y+1:IF
    Y=18 THEN Y=0
800 RETURN
1000 REM MESSAGE GENERATION PROGRAM
1010 POKE 752,1:CR=29:CRL=13:CL=12:CRR=28:CD=23:CDU=18:CU=17:
     CUD=22
1015 REM
1020 REM *** MAIN PROGRAM ***
1025 REM
1030 REM ** CHECK IF MESSAGE IN PROGRESS
1040 GRAPHICS 0:REM * CLEARS SCREEN
1050 GOSUB KEYBOARD
1060 POSITION 5,1:? TM;" SPACES USED IN STORAGE.":POSITION
     6,3:? "NEW MESSAGE (y OR n)?"
1070 GOSUB PST:V=STRIG(0):IF V<>0 THEN 1070
1080 IF L<>110 AND L<>121 THEN 1070
1090 ANS$=CHR$(L):POSITION 28,3:? ANS$:POKE 763,155
1100 IF ANS$="y" THEN 1300
1110 POSITION 4,5:? "WANT TO REVIEW PRESENT MESSAGE";:POSITION
     6,6:? "(y or n)?"
1120 GOSUB PST:V=STRIG(0):IF V<>0 THEN 1120
1130 IF L<>110 AND L<>121 THEN 1120
1140 ANS$=CHR$(L):POSITION 16,6:? ANS$:POKE 763,155
1150 IF ANS$="n" THEN GOSUB WIPE:GOTO 1200
1160 GOSUB WIPE:Y=0:IF TM<20 THEN 1200
1170 X=2
1180 FOR T=1 TO TM-20:POSITION X,Y:? CHR$(M(T))
1190 GOSUB CURSOR:NEXT T
1195 REM
1200 REM ** PRINTS LAST 20 BYTES IN MESSAGE STORAGE
1210 BG=TM-20:IF TM<20 THEN BG=1:REM ** BG = BEGINNING
1220 X=TM-(INT(TM/36)*36+19):IF TM<20 THEN X=2:GOSUB WIPE
1230 IF X<2 THEN X=X+36:REM ASSURES X POSITION ON THE LINE
1240 FOR T=BG TO TM:POSITION X,Y:? CHR$(M(T))
1250 GOSUB CURSOR:NEXT T
1260 GOTO 1350
1265 REM
1300 REM ** FOR PRINTING NEW MESSAGE
1310 X=2:Y=0:N=1:TM=0
```

A "T" with its stem pointing to the left allows backing up a space at a time, or continuously if the button is held down, to the beginning of the line. Similarly, a "T" with its stem to the right advances the cursor. Neither of these records in the message storage area, however, so to indicate a space forward, the keyboard cursor is moved to a point outside of the character area, which makes it invisible, and the button is pushed.

An upside down "T" has two functions, depending on the second character entered. If the same character is indicated by pressing the fire button, the message cursor will move to the corresponding position one line up. On the other hand, if a letter is selected for the second character, the letter is printed as a capital. Numerals and punctuation will not work.

If an interruption is necessary, moving the keyboard cursor to the diamond and pushing the button puts the menu back to the screen so that the interim task can be accomplished before returning to the message.

That's the skeleton. Shortly, perhaps with your help, I hope to flesh out this program so that my football player can begin exploring all the exciting possibilities his own computer can offer.

Explanation Of Listing

Lines 10-20: Locate subroutines, define arrays.

Line 30: Allows screen to receive input. PK controls overscan and can be adjusted for the particular television screen. ND allows a warning five spaces before end of line.

Lines 100-240: Present the entire menu program. ATASCII does not require the Basic statement GOTO in an IF...THEN statement.

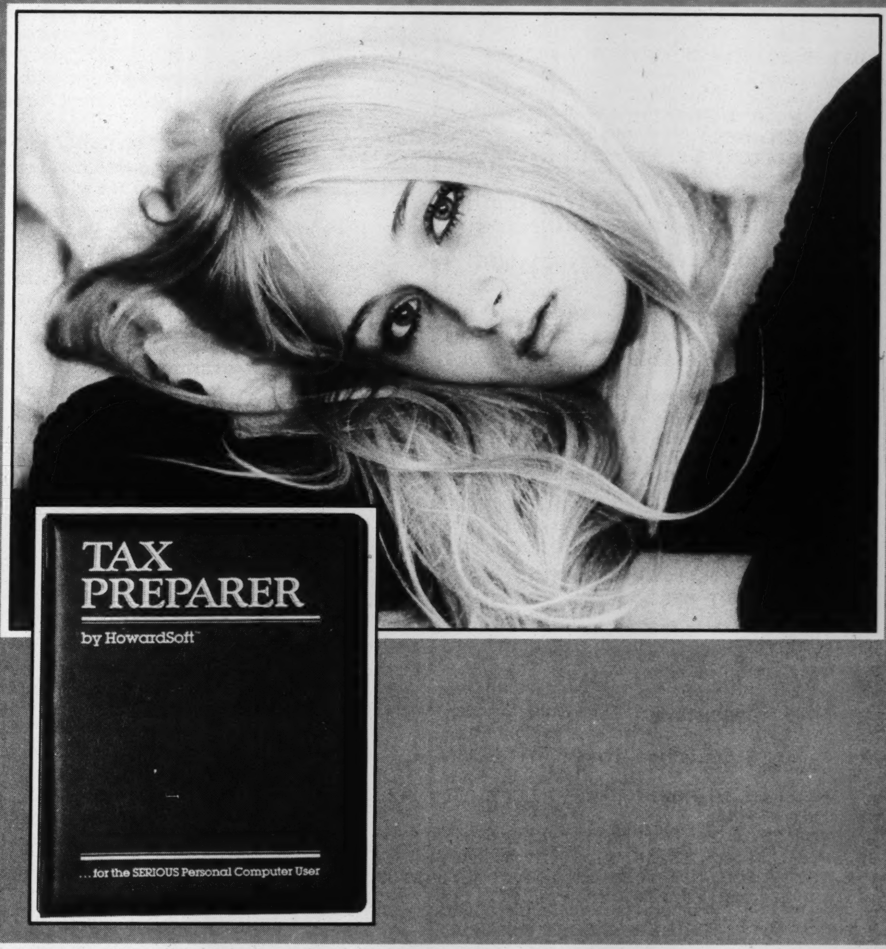
Line 260: This part of the WAIT subroutine determines the speed of response to the fire button. While learning, the upper limit of D could be increased. With proficiency it could be reduced to five or less.

Lines 280-390: The PST or keyboard cursor uses symbols in 300 and 350-380 to allow use in any menu routine. Parameters must be inserted peculiar to the particular routine. The cursor wraps around above and below, left and right to allow movement in any direction.

Line 410: POKE 77,0 turns off the Atari attract mode (which changes screen colors to prevent permanent screen marking by programs left on too long). Being placed in a subroutine only blocks the mode if the computer is being used.

Line 420: Indicates five spaces left on the line by ringing a bell. The Atari requires typing ESCAPE then CTRL and 2 for program use of the bell. In the listing it is represented by a "squiggly" in quotation marks.

RELAX!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CIRCLE 150 ON READER SERVICE CARD

```
1320 POSITION 3,9:? "ESTABLISHING MESSAGE STORAGE AREA":
     POSITION 7,11:? "(takes about 15 seconds)"
1330 FOR A=1 TO 1000:M(A)=ASC(" "):NEXT A
1340 GOSUB WIPE
1350 C=19:R=20
1355 REM
1360 REM ** INTERPRETATION OF LETTER VALUE
1365 REM
1370 GOSUB PST
1380 V=STRIG(0):IF V<>0 THEN 1370
1390 IF L=96 THEN GOTO MENU
1400 IF L=1 THEN POSITION X,Y:? CHR$(M(N)):X=X+1:N=N+1:IF X=38
     THEN X=37:N=N-1
1410 IF L=1 THEN POSITION X,Y:? CHR$(147):GOTO 1360
1420 IF L=4 THEN POSITION X,Y:? CHR$(M(N)):X=X-1:N=N-1:IF X=1
     THEN X=2:N=N+1
1430 IF L=4 THEN POSITION X,Y:? CHR$(147):GOTO 1360
1440 IF L=23 THEN GOSUB SKIP
1450 IF L=23 THEN 1360
1460 IF L=24 THEN GOSUB CAP
1470 IF L=24 THEN 1360
1480 POSITION X,Y:? CHR$(L):GOSUB CURSOR:M(N)=L:N=N+1:TM=TM+1
1485 REM
1500 REM ** FILLED MESSAGE STORAGE ROUTINES
1510 IF TM>=975 THEN TMPY=Y:Y=Y+1:IF Y=18 THEN Y=0
1520 IF TM>=975 THEN SL=1000-TM:IF SL<0 THEN SL=0
1530 IF TM>=975 THEN POSITION 2,Y:? "MESSAGE STORAGE HAS
     ";SL;" SPACES LEFT":Y=TMPY
1540 IF TM>=1000 THEN TMPY=Y:Y=Y+2:IF Y=16 THEN Y=0
1550 IF TM>=1000 THEN POSITION 0,Y:? B$:POSITION 3,Y:?
     "MESSAGE STORAGE IS FULL."
1560 IF TM>=1000 THEN Y=Y+1:POSITION 0,Y:? B$:POSITION 4,Y:?
     "GO TO MENU AND PRINT MESSAGE":Y=TMPY:TM=1000
1570 IF TM=1000 THEN GOSUB PST:IF L<>96 THEN 1570
1580 IF TM=1000 AND L=96 THEN GOTO MENU
1590 GOTO 1360
1595 REM
1600 REM ** KEYBOARD SUBROUTINE
1610 RESTORE
1620 FOR ROW=1 TO 4:FOR COLUMN=1 TO 14
1630 READ VALUE
1640 POSITION 12+COLUMN,18+ROW:? CHR$(VALUE)
1650 NEXT COLUMN:NEXT ROW
1660 POKE 752,1:POSITION 28,19:? CHR$(96):C=14:R=21:RETURN
1670 DATA 4,48,49,50,51,52,53,54,55,56,57,43,45,61
1680 DATA 24,97,98,99,100,101,102,103,104,105,106,107,108,109
1690 DATA 23,110,111,112,113,114,115,116,117,118,119,120,121,
     122
1700 DATA 1,44,46,63,33,59,58,39,38,36,47,37,40,41
1705 REM
2000 REM *** TO PRINT MESSAGE ***
2010 GRAPHICS 0:POKE 752,1
2020 IF TM=0 THEN POSITION 4,2:? "THERE IS NO MESSAGE IN
     STORAGE.     RETURNING TO MENU":GOSUB DELAY:GOTO MENU
2030 X=2:Y=0
2040 FOR T=1 TO TM
2050 POSITION X,Y:? CHR$(M(T))
2060 X=X+1
2070 IF X=PK THEN X=2:Y=Y+1
2080 IF Y=18 THEN Y=0
2090 NEXT T:GOSUB DELAY
2095 REM
2100 GOTO MENU
3000 REM *** TELEPHONE/MODEM CONNECTION ***
3010 GRAPHICS 0:POSITION 4,2:? "TELEPHONE IS AT PRESENT
     INOPERABLE.  RETURNING TO MENU":GOSUB DELAY:GOTO MENU
3015 REM
5000 REM *** ELECTRICAL CONNECTIONS ***
5010 GRAPHICS 0:POSITION 4,2:? "LIGHTS HAVE NOT BEEN CONNECTED.
     RETURNING TO MENU":GOSUB DELAY:GOTO MENU
```

Lines 430-450: Position the cursor through 18 36-character lines of message erasing each successively occupied line (Line 450: PRINT B$).

Line 460: ATASCII 147 is a cross symbol used as the message cursor.

Lines 470-560: The CAP subroutine uses the same symbol either to move the message cursor up one line or to capitalize the next letter.

Lines 700-800: The Skip for Spacing subroutine 1) allows the cursor to be moved to the next line without affecting the total number of characters in storage for editing purposes, or 2) allows the intervening spaces in storage during message preparation.

Line 1010: POKE 752,1 turns off the Atari cursor. The keyboard cursor limits are dimensioned.

Lines 1040-1260: Check to see if a message is in progress or if a new program is desired. POKE 763,155 (Lines 1090 and 1140) automatically cause a RETURN, and the program progresses after an answer is entered. If a program is in preparation it can be reviewed in its entirety (beginning Lines 1180-1190) or for only the last twenty bytes (Lines 1210-1260).

Lines 1300-1340: If a new message is desired, the message array is filled with blanks (Line 1330) and the screen cleared (Line 1340) of previous contents except for the keyboard. Line 1320 gives something to stare at for what seems a lot longer than 15 seconds.

Line 1350: When ready for use, the keyboard cursor is centered on letter "f" and blinks its location. "f" is in the middle of everything.

Lines 1370-1470: Check to see if a keyboard selection has been made (Line 1380) and check for a control character.

Line 1480: If not a control character, the selection is printed and the length of the message (TM) and the next letter array (N) and cursor position (X) increased.

Lines 1500-1580: Handle filling of the message storage array by "counting down" the last 25 letters, then indicating the need to print the message.

Lines 1600-1700: Produce the on-screen keyboard. The small letters are the default position. ATASCII 86 (Line 1660) prints a diamond, the escape symbol. ATASCII 4, 24, 23, 1 (Lines 1670-1700) present a "T" with the vertical portion turned left, up, down and right to represent backspace, revert one line or capitalize, advance to the beginning of the next line and move forward one space respectively. They are made transparent by lines 1400-1460 so they do not effect the already established character on the screen or in storage.

Lines 2000-2090: Print the message on the television screen.

Lines 3000-5010: Program areas are established for future telephone and lights control. □

Professional Software

for TRS-80 computers

Investment Analysis

CS-3305 Cassette (32K) $24.95

This program was originally developed for personal use by an investment specialist. Creative Computing Software now makes this package available for you to analyze your investments and investment decisions. Programs in this package include regression analysis, stock market simulations, market/stock values, risk analysis, time related investments, and tax analysis.

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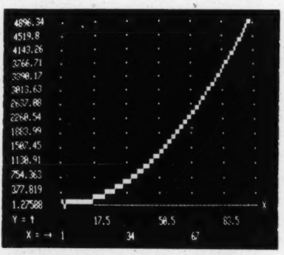
This package provides a variety of interesting and useful graphing routines. Graphing Package combines text and TRS-80 graphics to plot a variety of functions and other graphs.

1. Bar Graph

Bar Graph plots graphs for up to six different categories. An optional display does conversion to a line graph.

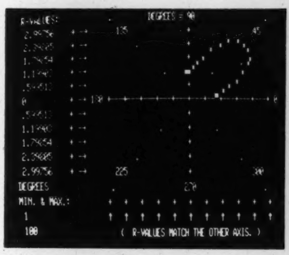


2. Cartesian Coordinate Graphing

This program plots a standard X, Y graph from a user entered function. A special feature of this program automatically scales of the Y-axis.

3. Polar Coordinate Graphing

Rarely found in computer graphing packages, this polar graphing program provides plots of polar functions. The program labels all axes, features automatic scaling, and lets you input the range and increment of the plot. A unique and valuable program.



4. Parametric Graphing

Parametric functions are functions in which both x and y are expressed in terms of an independent variable t. The resulting graph is X vs. Y. This program allows the user to input two parametric functions and produces a graph.

5. Linear and Parabolic Regression

These two programs are used for data analysis which can later be entered into the graphing routines. Regression routines analyze how well a series of points fit on a linear or quadratic function.

Advanced Statistics

CS-3303 Cassette (16K) $24.95 CS-3505 Disk (32K) $24.95

This package may be the ultimate in statisical applications for the TRS-80. Advanced Statistics will provide you with the ability to perform statistical tests never before available on small computers. Its cassette based data file system allows you to store, retrive and transform data files for use in several different tests.

1. File Manager

File Manager, the heart of the statistical file management, allows you to create, edit, and transform data files. Unique to this program are features that allow the user to perform transformations on variables, extract and create subfiles, and selectively copy records. Up to twenty variables and an unlimited number of cases can be processed.

2. Descriptive Statistics

Descriptive Statistics computes the mean, standard deviation, standard error of estimate, variance, skewness, kurtosis, range, median, and quartiles for a variable and constructs a histogram for each value. A test scoring option for conversion of raw scores into percentiles is included.

3. Two Variable Statistics

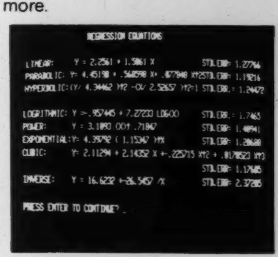
This program calculates descriptive statistics for each variable. It performs a t-test for the difference of means, computing the product-moment correlation coefficient and its associated significance level. In addition, it performs linear regression and computes standard error of estimate for Y.

4. Crosstabulation

This program constructs contingency tables for displaying frequencies, column percentages and table-wide percentages for each cell. It computes the Chi-square, the level of significance and gamma statistics. Tables as large as 10x10 may be evaluated.

5. Regression-Trend Analysis

This program computes least-squares regression coefficients from time-series or paired data for best-fit equations (linear, parabolic, hyperbolic, logarithmic, power, exponential and cubic types). Calculates standard error of estimate for each equation and more.



```
              REGRESSION EQUATIONS

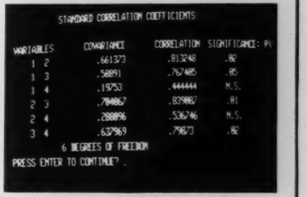
 LINEAR:     Y = 2.2561 + 1.5861 X          STD.ERR= 1.27766
 PARABOLIC: Y= 4.45198 + .568598 X+ .077848 X↑2STD.ERR= 1.19216
 HYPERBOLIC:(Y/ 4.34462 )↑2 -(X/ 2.52657 )↑2=1 STD.ERR.= 1.24472

 LOGRITHMIC: Y =-.957445 + 7.27233 LOG(X)   STD.ERR.= 1.7465
 POWER:      Y = 3.1093 (X)↑ .71847         STD.ERR= 1.40941
 EXPONENTIAL:Y= 4.39792 ( 1.15347 )↑X       STD.ERR= 1.20688
 CUBIC:      Y= 2.11294 + 2.14352 X +-.225715 X↑2 + .0178523 X↑3
                                            STD.ERR= 1.17665
 INVERSE:    Y = 16.6232 +-26.5457 /X       STD.ERR= 2.37285

 PRESS ENTER TO CONTINUE? _
```

6. Multiple Linear Regression

Performs multiple linear regression using up to ten independent variables. The program computes both unstandardized and normalized coefficients, covariance, multiple correlation coefficient, and the standard error of estimate.



```
         STANDARD CORRELATION COEFFICIENTS

 VARIABLES      COVARIANCE    CORRELATION  SIGNIFICANCE: P<
    1  2          .661373       .813248        .02
    1  3          .58891        .767485        .05
    1  4          .19753        .444444        N.S.
    2  3          .704867       .839887        .01
    2  4          .288096       .536746        N.S.
    3  4          .637969       .79873         .02
          6 DEGREES OF FREEDOM
 PRESS ENTER TO CONTINUE? _
```

7. Correlation Analysis

Computes product-moment correlation matrices, multiple correlation coefficients and partial correlation coefficients with their associated significance levels.

8. Analysis of Variance

This program performs one-way and two-way analysis of variance for a maximum of ten groups in each control variable. Statistics include the mean and standard deviation for each group, sum of the squares, degrees of freedom, mean square, F-ratios, and significance level.

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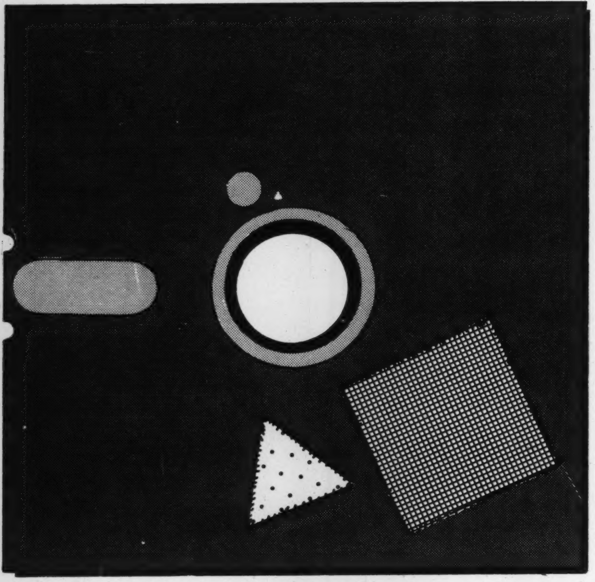
PATCHY PASCAL

Bob Reese



For Apple Basic users, the fact that the monitor program, which contains all the keyboard and screen routines, is cast in concrete in the form of read-only memory can be irritating at times. However, for Apple Pascal users, this is not the case. The Apple Pascal monitor can be patched or modified in any manner desired, or even discarded and a new one provided by the user. Why one would want to modify the Pascal monitor and how to do it is the subject of this article.

In Apple Pascal, all input/output subroutines, written in 6502 assembly language, are contained in the file SYSTEM.APPLE on the disk APPLE1. Collectively, these routines are called the Pascal Basic I/O Subsystem (BIOS). The BIOS not only contains routines for the keyboard and screen but also for printer, serial and communication interface cards.

Thus far, there have been two instances where I found it necessary to change the BIOS to fit my particular needs. Several months ago, I bought a printer and constructed a parallel interface card for it. In the Pascal system, a printer interface card can only be located in slot 1 and must have the hex value 4B in memory locations $C105 and $C107. Because my interface card did not have read-only memory it failed this test and was not recognized by Pascal as being online. To remedy this, I simply altered the BIOS so that the printer tests were skipped. Also, the BIOS printer routines were altered as they were not compatible with the interface. When I bought a lower-case adapter for my Apple, I had to alter the BIOS screen and keyboard subroutines so that they would accept lower-case letters. As the routines stood, they would intercept all lower-case letters and convert them to upper case.

To make modifications to the BIOS, an assembled listing of BIOS, which can be obtained from Apple free of charge, is a necessity. This listing gives the starting locations, by block number and byte number, of all the input/output drivers (screen, board, printer, etc.) located in the file SYSTEM.APPLE. The routines are well commented and easy to follow.

I wrote two programs to aid me in modifying the BIOS. The first program, Look (Listing 1), opens the file SYSTEM.APPLE to the specified block number and starting byte and reads to the given stop byte, outputting each byte in hex format. I used this program to check the contents of SYSTEM.APPLE before and after patching. Listing 2 contains the program BiosPatch which was used to accomplish the patching to the BIOS. To use BiosPatch, assemble the code you wish to patch into SYSTEM.APPLE using the Pascal 6502 Assembler. Upon execution of BiosPatch it will ask for the code file to be patched into SYSTEM.APPLE, the length in bytes of the patch, and the starting position (block number, byte number) of the patch in SYSTEM.APPLE. The byte length of the patch is the last value of the program counter in the assembled listing of the patch. Listing 3 gives an assembled printer subroutine to be patched into the BIOS. Listing 4 shows the execution of BiosPatch to accomplish the patching of the printer subroutine into SYSTEM.APPLE. Verification that the patch was entered correctly in SYSTEM.APPLE is accomplished by using program Look. ☐

Bob Reese, 1815D Welsh, College Station, TX 77840.

Listing 1.

```
PROGRAM LOOK;
VAR  BUFFER:PACKED ARRAY[0..511]OF CHAR;
     STOP,START,BLOCKNUMBER,I:INTEGER;
     HEX:STRING[2];CO:CHAR;G:FILE;

PROCEDURE CONVERT;
VAR I,J:INTEGER;

(* CONVERTS ASCII CHARACTER TO HEX FORMAT *)

 BEGIN
  I:=ORD(CO) MOD 16;
  J:=ORD(CO) DIV 16;
  IF J>9 THEN HEX[1]:=CHR(55+J)
   ELSE HEX[1]:=CHR(48+J);
  IF I>9 THEN HEX[2]:=CHR(55+I)
   ELSE HEX[2]:=CHR(48+I);
 END;


 BEGIN
  HEX:='  ';
  WRITE('Enter blocknumber ');
  READLN(BLOCKNUMBER);
  WRITE('Enter start & stop bytes (x,y) ');
  READ(START);
  READ(CO);
  READ(STOP);
  RESET(G,'SYSTEM.APPLE');
  I:=BLOCKREAD(G,BUFFER,1,BLOCKNUMBER);
  FOR I:=START TO STOP DO
   BEGIN
    CO:=BUFFER[I];
    CONVERT;
    WRITELN(HEX);
   END;
 END.
```

Listing 2.

```
PROGRAM BIOSPATCH;
VAR F,G:FILE;
    CURRENTBLOCK,BLKCNT,NUMBLK,BYTEBEGIN,BTELEN,LEN,BYTE,BYTECOUNT:INTEGER;
    OLDBIOS:PACKED ARRAY[0..511]OF CHAR;
    NEWBIOS:PACKED ARRAY[0..511]OF CHAR;
    DUMMY:CHAR;
    PATCH:STRING;

  BEGIN
   WRITELN('Enter code file to be patched to SYSTEM.APPLE');
   READLN(PATCH);
   PATCH:=CONCAT(PATCH,'.CODE');
   WRITELN('Enter byte length of ',PATCH);
   READLN(BTELEN);
   WRITELN('Enter starting blocknumber, byte number of patch');
   WRITE('in SYSTEM.APPLE ');
   READ(CURRENTBLOCK);
   READ(DUMMY);
   READLN(BYTEBEGIN);
   NUMBLK:=BTELEN DIV 512;
   RESET(G,PATCH);
   RESET(F,'SYSTEM.APPLE');
   LEN:=512;
   BYTE:=BLOCKREAD(F,OLDBIOS,1,CURRENTBLOCK);
   BYTE:=BYTEBEGIN;
   FOR BLKCNT:=0 TO NUMBLK DO
    BEGIN
     IF BLKCNT=NUMBLK THEN LEN:=BTELEN MOD 512;
     BYTECOUNT:=BLOCKREAD(G,NEWBIOS,1,1+BLKCNT);
     FOR BYTECOUNT:=0 TO LEN-1 DO
      BEGIN
       OLDBIOS[BYTE]:=NEWBIOS[BYTECOUNT];
       BYTE:=BYTE+1;
       IF BYTE=512 THEN
        BEGIN
         BYTE:=BLOCKWRITE(F,OLDBIOS,1,CURRENTBLOCK);
         CURRENTBLOCK:=CURRENTBLOCK+1;
         BYTE:=BLOCKREAD(F,OLDBIOS,1,CURRENTBLOCK);
         BYTE:=0;
        END;
      END;
    END;
   BYTE:=BLOCKWRITE(F,OLDBIOS,1,CURRENTBLOCK);
   CLOSE(F,NORMAL);
   CLOSE(G,NORMAL);
  END.
```

Listing 3.

```
PAGE -  0
Current memory available:   10142
0000:
0000:                              ;Printer output routine to be patched into SYSTEM.APPLE at
0000:                              ;block 4, byte 48
0000:
0000:                              ;Enter routine with character to be sent to printer in
0000:                              ;accumalator
0000:
2 blocks for procedure code  9395 words left
 PAGE -  1 PRINT    FILE:
0000:                              .PROC PRINT
Current memory available:   9617
0000: C301              PIAPORT .EQU    0C301       ;Address for PIA port
0000: C30C              HNDSHK  .EQU    0C30C       ;Address for PIA handshake line
0000:
0000: 8D 01C3           SEND    STA     PIAPORT     ;Put character in PIA output port
0003: AD 01C3           LOOP    LDA     PIAPORT     ;Check MSB, if high printer not ready
0006: 30FB                      BMI     LOOP        ;Loop until printer ready
0008: A9 0C                     LDA     #0C
000A: 8D 0CC3                   STA     HNDSHK      ;Lower handshake line
000D: A2 00                     LDX     #0
000F: E8                LOOP2   INX                 ;Delay loop to form negative handshake pulse
0010: D0FD                      BNE     LOOP2
0012: A9 0E                     LDA     #0E
0014: 8D 0CC3                   STA     HNDSHK      ;Raise handshake line
0017: 60                        RTS
0018:
0018:                              .END
 PAGE -  2 PRINT    FILE:  SYMBOLTABLE DUMP

AB - Absolute    LB - Label    UD - Undefined    MC - Macro
RF - Ref         DF - Def      PR - Proc         FC - Func
PB - Public      PV - Private  CS - Consts

HNDSHK  AB C30C:  LOOP    LB 0003:  LOOP2   LB 000F:  PIAPORT  AB C301:  PRINT   PR ---:  SEND   LB 0000:
 PAGE -  3 PRINT    FILE:

Current minimum space is 9344 words

Assembly complete:       24 lines
     0   Errors flagged on this Assembly
```

Listing 4.

```
Enter code file to be patched to SYSTEM.APPLE
#5:PRINTPATCH

Enter byte length of #5:PRINTPATCH.CODE
24

Enter starting blocknumber, byte number of patch
in SYSTEM.APPLE 4,48



Enter blocknumber 4

Enter Start & stop bytes (X,Y) 48,71

8D
01
C3
AD
01
C3
30
FB
A9
0C
8D
0C
C3
A2
00
E8
D0
FD
A9
0E
8D
0C
C3
60
```

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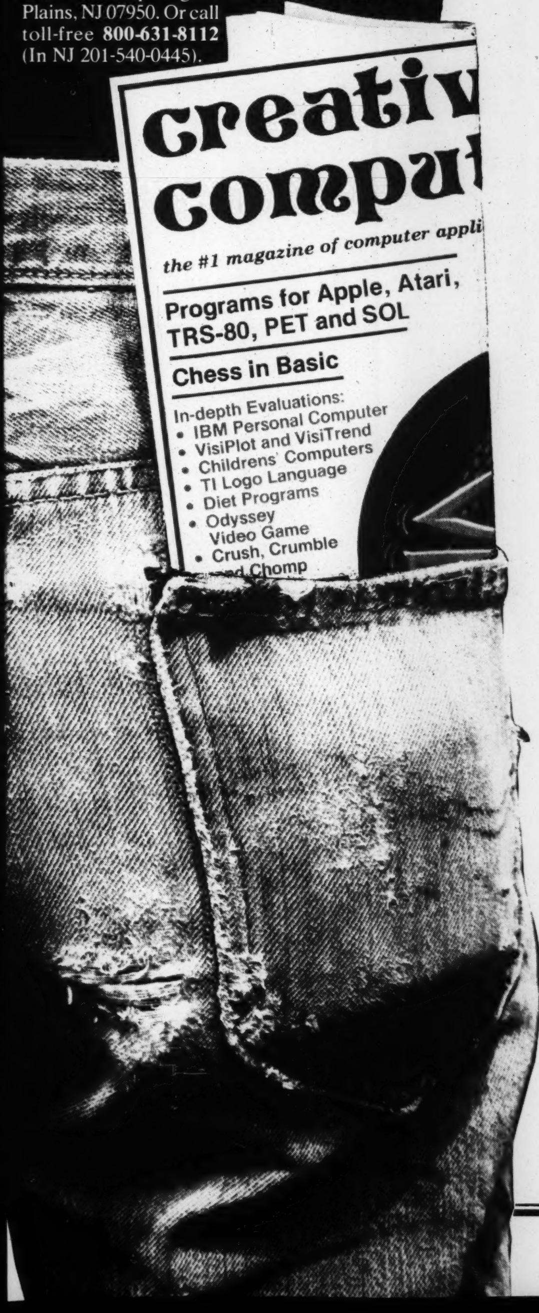

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Vol. 6, No. 10-October 1980

Symposium on Actor Languages and Smalltalk, Linked Merge Sort; How to Solve It; 9 New Applications and Games: Election Prediction, The Presidential Campaign. Computer Division Evaluations: OSI C2-4P Computer, TRS-80 Voxbox, Two Text Editors, Five Music Systems, 15 Software Packages, BASEX.

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Vol. 7, No. 9-Buyer's Guide

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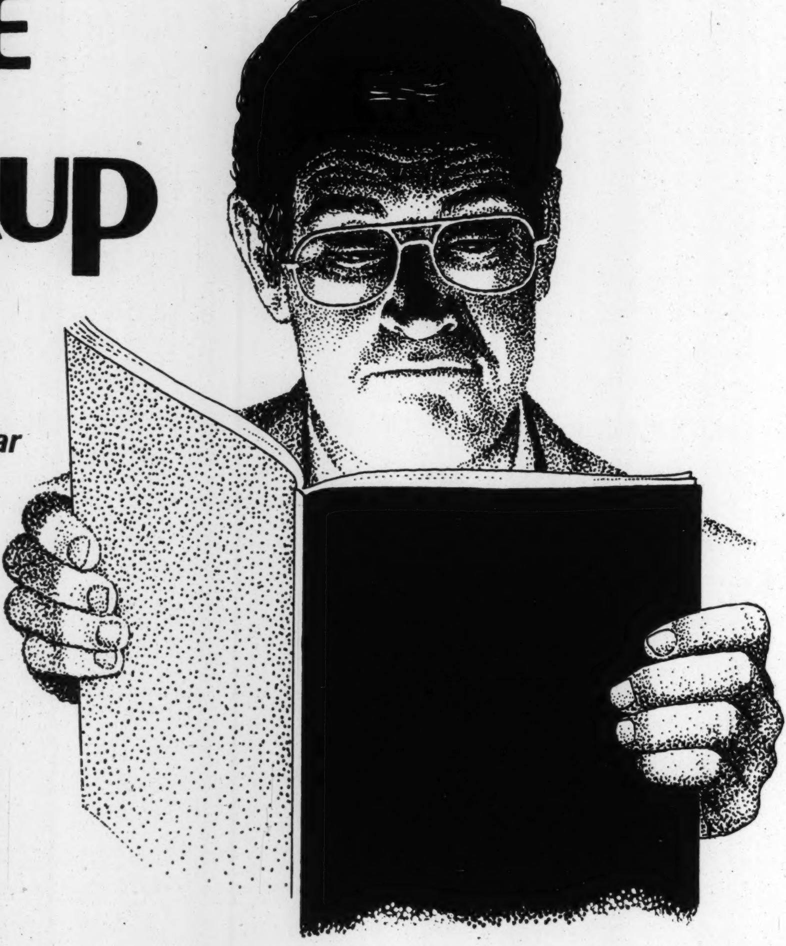
Educational Applications; Computer Tutor; Educational Software; Preschool Games; Xymec Printer; Cardreaders; Hi-Res Soccer; Nursery Rhymes to Shakespeare; Computers in Britain; PLATO; Simulations in the Classroom; Speed Reading; Aircraft Rescue; Wombats.

Vol. 7, No. 12-December 1981

Chess in Basic; Evaluation of IBM Personal Computer; VisiPlot and VisiTrend; Children's Computers; TI Logo Language; Diet Programs; Odyssey; Seeing Eye Computers; Arrays and Matrices; Model of a Solar System; Murphy's Eleventh Law; Seymour Papert.

Table Lookup

David Lubar



Despite rumors to the contrary, it is possible to write a slow machine language program. How? There are many ways, but the most common is to force the program to do large amounts of calculation. Take, for example, a program that makes use of square roots of numbers from one to one hundred. This is the sort of calculation that brings everything to a grinding crawl. A Basic programmer, faced with this problem, might store the values in an array. Then, if he wanted the square root of 76, he would simply use the value in A(76). This approach eats up RAM, but also speeds up execution. There is a similar approach in machine language. It is easy, fast, and powerful. It also can eat RAM, but RAM is cheap. Let's take an introductory stroll through table lookup. The examples that follow assume some familiarity with 6502 code, but anything beyond the basic concepts will be explained.

The 6502 contains several instructions that allow an index. For instance, while the command LDA $800 will load the accumulator with the value found in memory location $800, the command LDA $800,X uses the X register as an index. This means that the actual address for the load is used by taking the value in X and going that far beyond the base address. If X contains $5 then LDA $800,X will load from location $805. Just as array elements can be grabbed in Basic, values can be obtained through an indexed command. In Basic, to get the Nth element of an array, you would use "LET X = A(N)." In 6502 code, the commands would be

```
L

    1  LDX #$N
    2  LDA TABLE,X


:PR#0
```

Figure 1.

where the label TABLE stands for the starting address of the table. A nice aspect of such tables is that they need not be contiguous with the program, but can be

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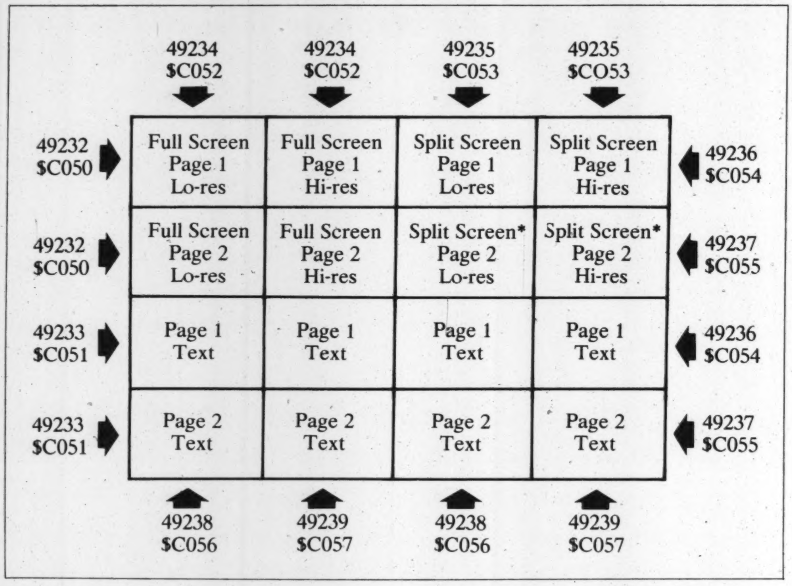
placed in any free area of RAM. Since the value of X is limited to values from zero to $FF, this particular example works only with tables restricted to 256 or fewer values. Also, the example deals with an index where each entry is only one byte. To deal with larger entries, the index value must be manipulated. For instance, suppose the index contains a series of two-byte entries. The program in Figure 2 would get the Nth entry (assuming N is less than $7F).

Taking the routine step by step, the number of the desired entry is first put in the accumulator. Since each entry is two bytes, its location in the table will be twice the index value. The first entry is indexed with zero and occupies the first two bytes of the table, the second entry begins two bytes from the start, the third begins four bytes from the start, and so on. The ASL shifts the accumulator byte to the left, thus multiplying the value by two. When this value is transferred to the X register, the program can make an indexed load from the table containing the required data.

Generally, table lookup increases speed and decreases *program* size, though it also usually increases RAM usage. Let's look at a concrete example, such as placing a letter on the text screen of the Apple.



	49234 $C052	49234 $C052	49235 $C053	49235 $CO53	
49232 $C050	Full Screen Page 1 Lo-res	Full Screen Page 1 Hi-res	Split Screen Page 1 Lo-res	Split Screen Page 1 Hi-res	49236 $C054
49232 $C050	Full Screen Page 2 Lo-res	Full Screen Page 2 Hi-res	Split Screen* Page 2 Lo-res	Split Screen* Page 2 Hi-res	49237 $C055
49233 $C051	Page 1 Text	Page 1 Text	Page 1 Text	Page 1 Text	49236 $C054
49233 $C051	Page 2 Text	Page 2 Text	Page 2 Text	Page 2 Text	49237 $C055
	49238 $C056	49239 $C057	49238 $C056	49239 $C057	

Chart 1A. Each side of the chart represents one pair of switches. The sixteen divisions contain the results of combining members from the four pairs. Values are shown in decimal and hexadecimal.

**Split screen graphics with page 2 displays four lines from the 2nd text screen. Since this area is usually occupied by Applesoft programs, the text will resemble garbage.*

Display Type
$C050, 49232 — Graphics Mode
$C051, 49233 — Text Mode

Display Format
$C052, 49234 — Full Screen (no effect
$C053, 49235 — Split Screen when in text mode)

Page Selection
$C054, 49236 — Page 1 ($2000 for hi-res $400 for lo-res or text)
$C055, 49237 — Page 2 ($4000 for hi-res $800 for low-res or text)

Graphics Type
$C056, 49238 — Lo-res (no effect when
$C057, 49239 — Hi-res in text mode)

Chart 1B. The addresses for the four pairs of switches. One of each pair is always on, the other other always off, even when a pair has no visible effect. For example, an Apple in the Text mode, when switched to the Graphics mode, will display the Graphics type (hi-res or lo-res) that was previously enabled.

```
:L

      1  LDA #$N ;GET THE ENTRY NUMBER
      2  ASL ;MULTIPLY BY TWO
      3  TAX ;MOVE THE INDEX NUMBER TO X
      4  LDA TABLE,X ;GET THE FIRST ENTRY
      5  STA TEMP ;SAVE IT SOMEWHERE
      6  INX ;POINT TO NEXT LOCATION IN INDEX
      7  LDA TABLE,X ;GET SECOND BYTE

:PR#0
```

Figure 2.

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Lookup, continued...

The mapping of the screen is somewhat complex. The memory location of the Nth line can be found through a series of calculations, but it is much easier to store the screen values in a table. Keeping the example simple, here's how a letter would be placed on the first column of the Nth screen row.

```
:L

LDX #ROW ;GET VERTICAL LOCATION
LDA SCREENLO,X ;GET LO BYTE FROM TABLE OF
SCREEN LOCATIONS
STA $0 ;SET UP ZERO PAGE POINTER
LDA SCREENHI,X ;GET HI BYTE
STA $01 ;COMPLETE ZERO PAGE POINTER
LDA #$ASCII ;ASCII VALUE TO PUT ON SCREEN
LDY #$0 ;ZERO THE Y REGISTER
STA ($0),Y ;PUT THE LETTER ON THE SCREEN

:PR#0
```

Figure 3.

The program uses two tables, one for the lo byte of the screen address, the other for the hi byte. Since the total number of entries is small, the tables could have been combined into pairs of bytes and accessed in the manner shown in Figure 2. To keep the example more general, two tables are accessed. The value in X is used to get the appropriate bytes from the table, and these bytes are stored in the zero page. The last command combines indexing and an indirect address. Indirect commands can be recognized by parentheses around the operand. Rather than use the address in the parentheses, the command uses the address *contained* by the location in the parentheses. In this example, locations zero and one contain the value of a screen address. The command shown takes the byte from the accumulator and transfers it into the location pointed to by zero and one, plus the offset indicated by Y (in this case, an offset of zero). While a technique such as this wouldn't be used for putting messages on the screen or in other cases where speed isn't essential, it could be used for text animation. For instance, the routine in Listing 1 moves a letter around the screen under paddle control.

While not the most elegant code for the job, the program demonstrates a way to use tables. In this case, calculating the address would not substantially increase the delay. The calculation could be done instead of using a delay between paddle reads. But in large programs, where many calculations are required, tables can make a vast difference. An analogous procedure is used for putting values on the hi-res screen. In such cases, the table has 192 entries each for the lo and hi bytes of the screen lines.

As an addendum to this, tables can be stuffed with cyclical values. Rather than have a screen table with 24 entries, they can be repeated until 256 bytes are filled. This would allow wraparound. On the other hand, entries beyond 24 could point to an unused area of RAM, thus making anything vanish when it moved off the screen.

Note: Due to the specialized nature of articles on machine language, we need feedback from you. Do you want more articles in this area? Specifics would be nice. Do you want general code techniques or machine-specific routines? Please let us know. ☐

Listing 1.

```
:ASM
     *ROUTINE TO MOVE A LETTER
     *UNDER PADDLE CONTROL
     *USES A LOOKUP TABLE WITH
     *SCREEN LOCATIONS
     *
     *
               ORG  $1000
     OLDH      EQU  $02     ;OLD HORIZONTAL LOCATION
     OLDV      EQU  $03     ;OLD VERTICAL LOC.
     NEWH      EQU  $04     ;NEW HORIZONTAL LOC.
     NEWV      EQU  $05     ;NEW VERTICAL LOC.
     KEY       EQU  $C000   ;KEYBOARD INPUT
     STROBE    EQU  $C010   ;CLEARS KEYBOARD
     PREAD     EQU  $FB1E   ;PADDLE READ X=PDL NUMBER. RETURNS VALUE IN Y.
     HOME      EQU  $FC58   ;CLEARS SCREEN
     DELAY     EQU  $FCA8   ;MONITOR WAIT ROUTINE
```

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CIRCLE 158 ON READER SERVICE CARD

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CIRCLE 167 ON READER SERVICE CARD

Lookup, continued...

```
                 *
1000: 20 58 FC   START    JSR  HOME    ;CLEAR THE SCREEN
1003: A2 0C                LDX  #$0C    ;FIRST STEP BEFORE
1005: 86 03                STX  OLDV    ;LOOP IS TO
1007: A0 14                LDY  #$14    ;PUT THE LETTER ON
1009: 84 02                STY  OLDH    ;THE SCREEN
100B: A9 C1                LDA  #$C1    ;X=ROW,Y=COLUMN,A=ASCII CHARACTER
100D: 20 5D 10             JSR  DRAW    ;SUBROUTINE FOR DISPLAY
1010: AD 00 C0   CHECK     LDA  KEY     ;READ KEYBOARD
1013: 10 04                BPL  LOOP    ;NO KEYPRESS
1015: 2C 10 C0             BIT  STROBE  ;KEY PRESSED. CLEAR STROBE
1018: 60                   RTS         ;AND GO HOME
1019: A9 80      LOOP      LDA  #$80    ;MUST DELAY BETWEEN PDL READS
101B: 20 A8 FC             JSR  DELAY   ;OR READING WILL BE WRONG
101E: A2 00                LDX  #$0     ;READ PDL 0
1020: 20 1E FB             JSR  PREAD
1023: 98                   TYA         ;PUT PDL VALUE IN A AND
1024: 4A                   LSR         ;DIVIDE BY 8
1025: 4A                   LSR         ;TO FIT SCREEN WIDTH
1026: 4A                   LSR
1027: 85 04                STA  NEWH    ;SAVE IT AS NEW HORIZONTAL LOC.
1029: A9 80                LDA  #$80    ;DELAY AGAIN
102B: 20 A8 FC             JSR  DELAY
102E: A2 01                LDX  #$01    ;READ PDL 1
1030: 20 1E FB             JSR  PREAD
1033: 98                   TYA
1034: 4A                   LSR         ;DIVIDE BY 16
1035: 4A                   LSR         ;TO FIT SCREEN
1036: 4A                   LSR
1037: 4A                   LSR
1038: 85 05                STA  NEWV    ;SAVE NEW VERTICAL LOC.
103A: C5 03                CMP  OLDV    ;CHECK FOR CHANGE
103C: D0 06                BNE  NEXT    ;YES, THERE WAS A CHANGE
103E: A5 02                LDA  OLDH    ;CHECK FOR CHANGE IN OTHER READING
1040: C5 04                CMP  NEWH
1042: F0 CC                BEQ  CHECK   ;NO CHANGE. GO BACK.
1044: A6 03      NEXT      LDX  OLDV    ;AT LEAST ONE PDL CHANGED
1046: A4 02                LDY  OLDH    ;MUST ERASE OLD LOC.
1048: A9 A0                LDA  #$A0    ;A0=ASCII FOR SPACE
104A: 20 5D 10             JSR  DRAW    ;GO TO IT.
104D: A6 05                LDX  NEWV    ;UPDATE OLD LOCATIONS
104F: 86 03                STX  OLDV    ;AND PREPARE TO DRAW
1051: A4 04                LDY  NEWH    ;THE LETTER AT THE
1053: 84 02                STY  OLDH    ;NEW LOCATION
1055: A9 C1                LDA  #$C1    ;C1=ASCII FOR A
1057: 20 5D 10             JSR  DRAW    ;DO IT
105A: 4C 10 10             JMP  CHECK   ;GO BACK FOR MORE
105D: 48         DRAW      PHA         ;SAVE THE DESIRED CHARACTER
105E: BD 84 10             LDA  SCLO,X ;GET LO BYTE OF LINE LOCATION
1061: 85 00                STA  $00     ;PUT IT IN ZERO PAGE
1063: BD 6C 10             LDA  SCHI,X ;GET HI BYTE
1066: 85 01                STA  $01     ;POINTER NOW READY
1068: 68                   PLA         ;RESTORE DESIRED CHARACTER
1069: 91 00                STA  ($0),Y ;ON THE SCREEN AT LAST
106B: 60                   RTS         ;BACK FOR MORE
                 *TABLE OF SCREEN LOCATIONS LISTED BELOW
                 *HI BYTES FIRST, THEN LO BYTES
106C: 04 04      SCHI      HEX  04,04
106E: 05 05                HEX  05,05
1070: 06 06                HEX  06,06
1072: 07 07                HEX  07,07
1074: 04 04                HEX  04,04
1076: 05 05                HEX  05,05
1078: 06 06                HEX  06,06
107A: 07 07                HEX  07,07
107C: 04 04                HEX  04,04
107E: 05 05                HEX  05,05
1080: 06 06                HEX  06,06
1082: 07 07                HEX  07,07
1084: 00 80      SCLO      HEX  00,80
1086: 00 80                HEX  00,80
1088: 00 80                HEX  00,80
108A: 00 80                HEX  00,80
108C: 28 A8                HEX  28,A8
108E: 28 A8                HEX  28,A8
1090: 28 A8                HEX  28,A8
1092: 28 A8                HEX  28,A8
1094: 50 D0                HEX  50,D0
1096: 50 D0                HEX  50,D0
1098: 50 D0                HEX  50,D0
109A: 50 D0                HEX  50,D0


--- END ASSEMBLY ---

TOTAL ERRORS: 0

156 BYTES GENERATED THIS ASSEMBLY
```

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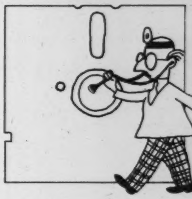

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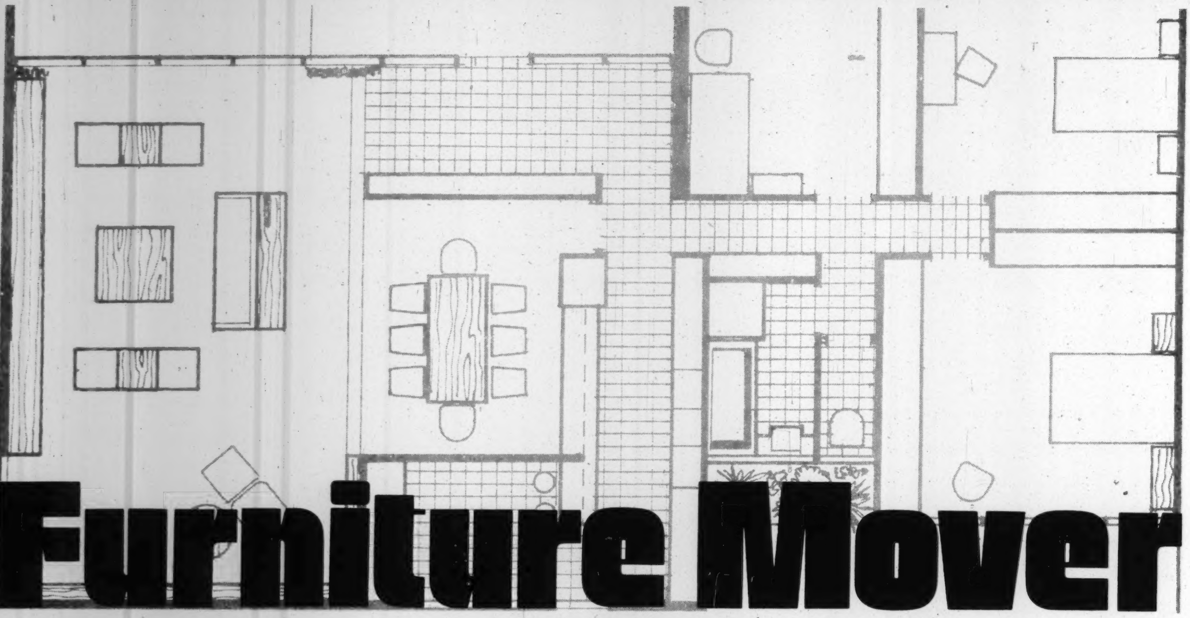
CIRCLE 202 ON READER SERVICE CARD



Furniture Mover

Don Opedal

Have you ever rearranged the furniture in a room only to discover you didn't like it that way? Or have your ever made a "model" of a room with pieces of paper to represent pieces of furniture and tried to arrange them?

I moved recently and wanted to know what pieces of furniture were going to be in which room before the movers arrived. I was about to cut out the little pieces of paper when I remembered the graphics capability of my Apple II. The following program helped me decide where to place each piece.

How It Works

Several shapes are created to represent the room and each piece of furniture using a scale of one dot per inch. The shape can be as complex as desired. My example table uses simple rectangles to represent each piece. The program also creates two shapes (shapes 1 and 2) to be used as "markers" for measuring distances. The actual creation of the "user's shapes" is left to the user. They may be created with a shape-drawing program or by hand, following the directions in the Apple manuals.

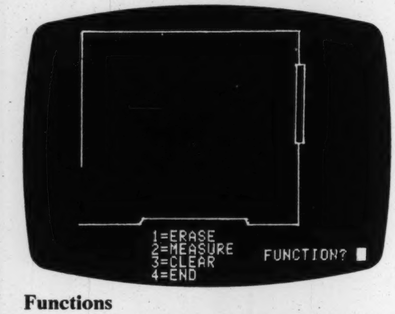
The shapes created may be placed anywhere in memory that does not interfere with the program or the system. My example places the shapes at 4096 (1000 hex). The user must put the starting pointers for each shape in the shape table. The program initiates the shape table at 768 (300 hex) and creates the first two shapes. These are small squares and start at 950 (3B6 hex) and 963 (3C3 hex). The program also puts the starting location of the shape table at 232 and 233 (E8 and E9 hex).

Don Opedal, 9550 Cove Dr. D-19, North Royalton, OH 44133.

Running the Program

The program first asks for the number of user shapes. This is the number of shapes you have created: the room and each piece of furniture. The example has six user shapes.

The program will then draw the first user shape and the outline of the room, and ask for the next shape to draw. The program will not accept shapes 1, 2 or 3 nor any number greater than the total number of shapes. Remember, the first shape representing a piece of furniture is shape 4. Entering a zero allows various functions to be used.



```
1=ERASE
2=MEASURE     FUNCTION? █
3=CLEAR
4=END
```

Functions

The following functions are available:

1) ERASE. This allows any shape to be erased by shape number, and allows the user to remove any shape not desired.

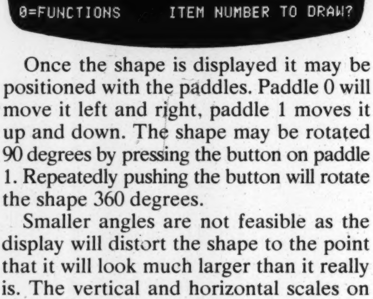
2) MEASURE. This allows the user to measure distances.

3) CLEAR. Occasionally random "garbage" will remain in the drawing. CLEAR erases any points not desired and redraws the room and any other shape that has been selected.

4) END. Exits the program.

Drawing Shapes

Entering the number of your shape will cause it to be drawn on the screen. Remember, shapes 1 and 2 are reserved and shape 3 is the room, so your first shape is shape 4.



```
0=FUNCTIONS     ITEM NUMBER TO DRAW?
```

Once the shape is displayed it may be positioned with the paddles. Paddle 0 will move it left and right, paddle 1 moves it up and down. The shape may be rotated 90 degrees by pressing the button on paddle 1. Repeatedly pushing the button will rotate the shape 360 degrees.

Smaller angles are not feasible as the display will distort the shape to the point that it will look much larger than it really is. The vertical and horizontal scales on the display are different, but since each shape is equally distorted the relative positions are the same.

Once the shape is positioned as desired, pressing the button on paddle 0 causes it to remain in place, and the program asks for another shape to draw. A shape may be moved by using the erase function or by reselecting a previously drawn shape. If any garbage remains on the screen it may be erased by selecting the clear function.

After the shapes are drawn you may want to know the distance between one

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CIRCLE 137 ON READER SERVICE CARD

piece of furniture and another. Selecting the measure function causes a small square to be displayed. Using the paddles, position the center of the square at the first point and push the button on paddle 0. The square remains at this point and another square may be moved to the point at the end of the distance to be measured. The distance between squares, in feet and inches, will be displayed. Pushing the button on paddle 1 will cause the measure function to end.

Conclusion

Each section of the program is marked and is fairly straight forward. I have not used any "secret" memory locations and the use of the shape tables is well documented in the Apple manuals. The program helped me to make decisions in advance of the moving day so I knew where I wanted the furniture to go. It would also be possible to use the program for other applications, such as laying out a garden. Once the shapes are drawn and entered the program is easy to use. ☐

Example table. Shows the shape table at 300 hex and the shapes at 1000 hex.

```
0300- 08 00 B6 00 C3 00 00 0D   1168- 06 00 3F 3F 3F 3F 3F 3F
0308- 6A 0E FB 0E 21 0F 47 0F   1170- 3F 3F 3F 3F 3F 3F 3F 3F
0310- 7C 0F                     1178- 3F 3F 3F 3F 3F 3F 3F 3F
1000- DB DB DB DB DB DB DB DB   1180- 3F 3F 3F 3F 3F 3F 3F 3F
1008- DB DB DB DB DB DB DB DB   1188- 3F 3F 3F 3F 3F 3F 3F 3F
1010- DB DB DB DB DB DB DB DB   1190- 3F 3F 3F 3F 36 36 36 36
1018- DB DB DB DB DB DB DB DB   1193- 36 36 36 36 36 36 36 36
1020- DB DB DB DB DB DB DB DB   11A0- 36 36 36 36 36 36 36 36
1028- DB DB DB DB DB DB 33 36   11A8- 36 36 36 36 36 36 36 36
1030- 36 36 36 36 36 36 36 36   11B0- 36 36 2D 2D 2D 2D 2D 2D
1038- 36 36 36 36 36 36 36 36   11B8- 2D 2D 2D 2D 2D 2D 2D 2D
1040- 36 36 36 36 36 36 36 96   11C0- 2D 2D 2D 2D 2D 2D 2D 2D
1048- 92 92 92 92 92 92 92 92   11C8- 2D 2D 2D 2D 2D 2D 2D 2D
1050- 92 2A 2D 2D 2D 2D 2D 2D   11D0- 2D 2D 2D 2D 2D 2D 2D 2D
1058- 2D 2D 2D 2D 2D 2D 2D 2D   11D8- 2D 2D 2D 2D 24 24 24 24
1060- 2D 25 2C 2D 2D 2D 2D 2D   11E0- 24 24 24 24 24 24 24 24
1068- 2D 2D 2D 2D 2D 2D 2D 2D   11E8- 24 24 24 24 24 24 24 24
1070- 2D 2D 2D 2D 2D 2D 2D 2D   11F0- 24 24 24 24 24 24 24 24
1078- 2D 2D 2D 2D 2D 2D 2D 2D   11F8- 24 24 00 3F 3F 3F 3F 3F
1080- 2D 2D 2D 2D 2D 2D 36 2D   1200- 3F 3F 3F 3F 3F 3F 37 36
1088- 2D 2D 2D 2D 2D 2D 2D 2D   1208- 36 36 36 36 36 2E 2D 2D
1090- 2D 2D 2D 2D 2D 2D 2D 2D   1210- 2D 2D 2D 2D 2D 2D 2D 2D
1098- 2D 2D 2D 25 24 24 24 24   1218- 2D 24 24 24 24 24 24 24
10A0- 24 24 24 24 24 24 24 24   1220- 00 3F 3F 3F 3F 3F 3F 3F
10A8- 24 24 24 24 24 24 24 24   1228- 3F 3F 3F 3F 37 36 36 36
10B0- 24 24 24 24 24 24 24 2C   1230- 36 36 36 2E 2D 2D 2D 2D
10B8- 25 24 24 24 24 24 24 24   1238- 2D 2D 2D 2D 2D 2D 2D 24
10C0- 24 24 24 24 24 24 24 24   1240- 24 24 24 24 24 24 00 3F
10C8- 24 24 24 24 24 24 24 24   1248- 3F 3F 3F 3F 3F 3F 3F 3F
10D0- 3F 3F 36 36 36 36 36 36   1250- 3F 3F 3F 3F 3F 3F 3F 3F
10D8- 36 36 36 36 36 36 36 36   1258- 36 36 36 36 36 36 36 36
10E0- 36 36 36 36 36 36 36 36   1260- 36 2D 2D 2D 2D 2D 2D 2D
10E8- 36 2E 3D 27 24 24 24 24   1268- 2D 2D 2D 2D 2D 2D 2D 2D
10F0- 24 24 24 24 24 24 24 24   1270- 2D 2D 24 24 24 24 24 24
10F8- 24 24 24 24 24 24 24 24   1278- 24 24 24 00 3F 3F 3F 3F
1100- 24 24 24 2D 24 24 24 24   1280- 3F 3F 3F 3F 3F 3F 3F 3F
1108- 24 24 24 24 3C 3F 3F 3F   1288- 3F 3F 3F 3F 3F 3F 3F 3F
1110- 3F 3F 3F 3F 3F 3F 3F 3F   1290- 3F 3F 3F 3F 3F 3F 3F 3F
1118- 3F 3F 3F 3F 3F 3F 3F 3F   1298- 3F 3F 37 36 36 36 36 36
1120- 3F 3F 3F 3F 3F 3F 3F 3F   12A0- 36 36 36 2E 2D 2D 2D 2D
1128- 3F 3F 3F 3F 3F 3F 3F 3F   12A8- 2D 2D 2D 2D 2D 2D 2D 2D
1130- 3F 3F 3F 3F 3F 3F 3F 3F   12B0- 2D 2D 2D 2D 2D 2D 2D 2D
1138- 3F 3F 3F 3F 3F 3F 3F 3F   12B8- 2D 2D 2D 2D 2D 2D 2D 2D
1140- 3F 3F 3F 3F 3F 3F 3F 3F   12C0- 2D 2D 24 24 24 24 24 24
1148- 3F 3F 3F 3F 3F 3F 3F 3F   12C8- 24 24 24 00 2D 36 36 3F
1150- 3F 3F 3F 3F 37 36 36 36   12D0- 3F 24 24 2D 05 00 2D 36
1158- 36 36 36 36 36 36 36 36   12D8- 36 3F 3F 24 24 2D 05 00
1160- 36 36 36 36 36 36 36 36
```

Listing 1.

```
10  REM  ***** INITIALIZE *****
20  LOMEM: 5000
30  FOR I = 950 TO 975
40  READ J: POKE I,J: NEXT I
50  DATA  54,54,54,63,63,63,36,36,36,45,45,45,00,
          54,54,54,63,63,63,36,36,36,45,45,45,00
60  POKE 232,45,00: POKE 233,03: POKE 769,00: POKE 770,182:
    POKE 771,00: POKE 772,195: POKE 773,00
70  HOME : INPUT "HOW MANY USER SHAPES? ";S: POKE 768,S + 2
80  HCOLOR= 3: SCALE= 1: ROT= 0: HGR
90 Z(3) = 1:X(3) = 139:Y(3) = 79
100  GOSUB 690
110  HOME : VTAB 23: HTAB 1: PRINT "0=FUNCTIONS"
120  VTAB 23: HTAB 17: INPUT "ITEM NUMBER TO DRAW? ";I
130  IF I = 0 THEN 250
140  IF I<4 THEN 120
150  IF I> S + 2 THEN 120
160 Z(I) = 1: HOME
170 R(0) = R(I)
180  VTAB 22: HTAB 1: PRINT "PADDLE 0";: HTAB 15: PRINT "PUSH";:
     HTAB 25: PRINT "PADDLE 1";
190  VTAB 23: HTAB 2: PRINT "POSITION";:HTAB16:PRINT"FOR";:
     HTAB 26: PRINT "ROTATE"
200 X(I) =  PDL (0):Y(I) =  PDL (1):Y(I) =  PDL (1)
210  IF Y(I)> 191 THEN Y(I)=191
220  GOSUB 610: IF  PEEK ( - 16384)> 127 THEN Z(I) = 0: GOTO 410
230  IF  PEEK ( - 16287)<128 THEN 200
240 R(0) = 0: GOTO 110
250  REM  ***** FUNCTIONS *****
260  HOME
270  VTAB 21: HTAB 1: PRINT "1=ERASE";
280  VTAB 22: HTAB 1: PRINT "2=MEASURE";
290  VTAB 23: HTAB 1: PRINT "3=CLEAR";
300  VTAB 24: HTAB 1: PRINT "4=END";
310  VTAB 23: HTAB 20: INPUT "FUNCTION? ";F
320  ON F GOTO 340,430,410,770
330  GOTO 310
340  REM  ***** ERASE ITEMS *****
350  HOME : VTAB 23: HTAB 1: INPUT "ITEN NUMBER TO ERASE? ";I
360  IF Z(I) = 0 OR I<4 THEN 110
370  ROT= R(I):Z(I)=0
380  XDRAW I AT X(I),Y(I)
390 R(I) = 0
400  GOSUB 690: GOTO110
410  REM  ***** CLEAR SCREEN *****
420  HGR : GOSUB 690: GOTO 110
430  REM  ***** MEASURE *****
440  HOME
450 Z(1) = 1:I = 1
460  IF  PEEK ( - 16286)> 127 THEN 600
470 X(I) =  PDL (0):Y(I) =  PDL (1):Y(I) =  PDL (1)
480  IF Y(I)> 191 THEN Y(I) = 191
490  IF  PEEK ( - 16287)<128 THEN 550
500  IF Z(2) = 0 THEN 520
510  XDRAW 2 AT XM,YM
520 X(2) = X(0):Y(2) = Y(0):Z(2) = 1
530 XM = X(0):YM = Y(0)
540  DRAW 2 AT XM,YM
550  IF XM = 0 AND YM = 0 GOTO 580
560 D =  SQR (((XM - X(I))^ 2) + ((YM - Y(I))^ 2))
570 D1 =  INT (D / 12):D2 =  INT ((D / 12 -  INT (D1))
     * 12 + .05)
580  VTAB 24: HTAB 1 : PRINT "DISTANCE= ";D1;"
     FEET ";D2;" INCHES ";
590  GOSUB 640: GOTO 460
600 Z(1) = 0:Z(2) = 0: HGR : GOSUB 690: GOTO 110
610  REM  ***** PLOT NEW SHAPES *****
620  IF  PEEK ( - 16286) > 127 THEN R(I) = R(I) + 16
630  IF R(I) = 64 THEN R(I) = 0
640  IF X(I) = X(0) AND Y(I) = Y(0) AND R(I) = R(0) THEN 690
650  IF X(0) = 0 AND Y(0) = 0 THEN 670
660  ROT= R(0): XDRAW I AT X(0),Y(0)
670  ROT= R(I): DRAW I AT X(I),Y(I)
680 R(0) = R(I):X(0) = X(I):Y(0) = Y(I)
690  REM  ***** PLOT OLD SHAPES *****
700  FOR N = 1 TO S + 2
710  IF Z(N) = 0 GOTO 50
720  IF X(N) AND Y(N) = 0 THEN 750
730  ROT= R(N)
740  DRAW N AT X(N),Y(N)
750  NEXT N
760  RETURN
770  END
```

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1 RULE78	Interest Apportionment by Rule of the 78's
2 ANNU1	Annuity computation program
3 DATE	Time between dates
4 DAYYEAR	Day of year a particular date falls on
5 LEASEINT	Interest rate on lease
6 BREAKEVN	Breakeven analysis
7 DEPRSL	Straightline depreciation
8 DEPRSY	Sum of the digits depreciation
9 DEPRDB	Declining balance depreciation
10 DEPRDDB	Double declining balance depreciation
11 TAXDEP	Cash flow vs. depreciation tables
12 CHECK2	Prints NEBS checks along with daily register
13 CHECKBK1	Checkbook maintenance program
14 MORTGAGE/A	Mortgage amortization table
15 MULTMON	Computes time needed for money to double, triple, etc.
16 SALVAGE	Determines salvage value of an investment
17 RRVARIN	Rate of return on investment with variable inflows
18 RRCONST	Rate of return on investment with constant inflows
19 EFFECT	Effective interest rate of a loan
20 FVAL	Future value of an investment (compound interest)
21 PVAL	Present value of a future amount
22 LOANPAY	Amount of payment on a loan
23 REGWITH	Equal withdrawals from investment to leave 0 over
24 SIMPDISK	Simple discount analysis
25 DATEVAL	Equivalent & nonequivalent dated values for oblig.
26 ANNUDEF	Present value of deferred annuities
27 MARKUP	% Markup analysis for items
28 SINKFUND	Sinking fund amortization program
29 BONDVAL	Value of a bond
30 DEPLETE	Depletion analysis
31 BLACKSH	Black Scholes options analysis
32 STOCVAL1	Expected return on stock via discounts dividends
33 WARVAL	Value of a warrant
34 BONDVAL2	Value of a bond
35 EPSEST	Estimate of future earnings per share for company
36 BETAALPH	Computes alpha and beta variables for stock
37 SHARPE1	Portfolio selection model-i.e. what stocks to hold
38 OPTWRITE	Option writing computations
39 RTVAL	Value of a right
40 EXPVAL	Expected value analysis
41 BAYES	Bayesian decisions
42 VALPRINF	Value of perfect information
43 VALADINF	Value of additional information
44 UTILITY	Derives utility function
45 SIMPLEX	Linear programming solution by simplex method
46 TRANS	Transportation method for linear programming
47 EOQ	Economic order quantity inventory model
48 QUEUE1	Single server queueing (waiting line) model
49 CVP	Cost-volume-profit analysis
50 CONDPROF	Conditional profit tables
51 OPTLOSS	Opportunity loss tables
52 FQUOQ	Fixed quantity economic order quantity model

NAME	DESCRIPTION
53 FQEOWSH	As above but with shortages permitted
54 FQEOQPB	As above but with quantity price breaks
55 QUEUECB	Cost-benefit waiting line analysis
56 NCFANAL	Net cash-flow analysis for simple investment
57 PROFIND	Profitability index of a project
58 CAP1	Cap. Asset Pr. Model analysis of project
59 WACC	Weighted average cost of capital
60 COMPBAL	True rate on loan with compensating bal. required
61 DISCBAL	True rate on discounted loan
62 MERGANAL	Merger analysis computations
63 FINRAT	Financial ratios for a firm
64 NPV	Net present value of project
65 PRINDLAS	Laspeyres price index
66 PRINDPA	Paasche price index
67 SEASIND	Constructs seasonal quantity indices for company
68 TIMETR	Time series analysis linear trend
69 TIMEMOV	Time series analysis moving average trend
70 FUPRINF	Future price estimation with inflation
71 MAILPAC	Mailing list system
72 LETWRT	Letter writing system-links with MAILPAC
73 SORT3	Sorts list of names
74 LABEL1	Shipping label maker
75 LABEL2	Name label maker
76 BUSBUD	DOME business bookkeeping system
77 TIMECLCK	Computes weeks total hours from timeclock info.
78 ACCTPAY	In memory accounts payable system-storage permitted
79 INVOICE	Generate invoice on screen and print on printer
80 INVENT2	In memory inventory control system
81 TELDIR	Computerized telephone directory
82 TIMUSAN	Time use analysis
83 ASSIGN	Use of assignment algorithm for optimal job assign.
84 ACCTREC	In memory accounts receivable system-storage ok
85 TERMSPAY	Compares 3 methods of repayment of loans
86 PAYNET	Computes gross pay required for given net
87 SELLPR	Computes selling price for given after tax amount
88 ARBCOMP	Arbitrage computations
89 DEPRSF	Sinking fund depreciation
90 UPSZONE	Finds UPS zones from zip code
91 ENVELOPE	Types envelope including return address
92 AUTOEXP	Automobile expense analysis
93 INSFILE	Insurance policy file
94 PAYROLL2	In memory payroll system
95 DILANAL	Dilution analysis
96 LOANAFFD	Loan amount a borrower can afford
97 RENTPRCH	Purchase price for rental property
98 SALELEAS	Sale-leaseback analysis
99 RRCONVBD	Investor's rate of return on convertable bond
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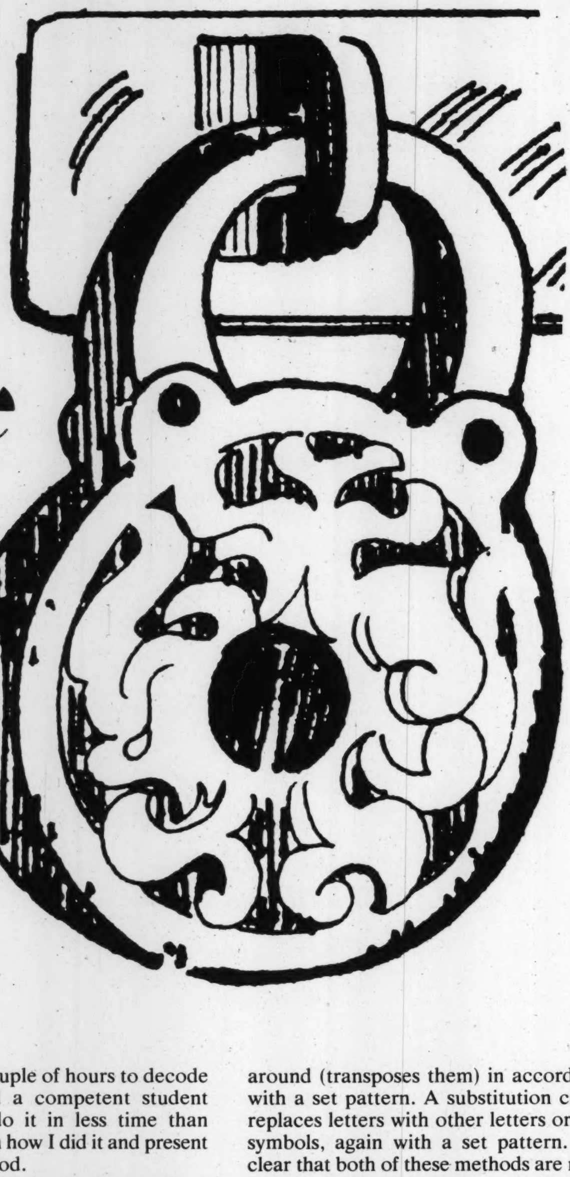
breaking the code



David Block

The security of data banks in computers is important. In the good old days of the IBM 704, part of the core memory was literally kept under lock and key. Every installation came equipped with a service engineer. The service engineer had a key. This key unlocked one of the bits in the program status word and made it possible to access otherwise forbidden memory. Unauthorized tampering with the system program was possible only with the help of the engineer. The console operator was unable to mess up the system as the programmers were.

The bigger and better systems we have today seem to rely on passwords and other feeble dodges. Users naively use their names or initials as passwords and feel secure. Students learn how to access systems from any telephone and how to get into the operating systems; data files must be encoded in order to make them secure.

A small system such as that described by Charles Noah in the March 1981 issue of *Creative Computing* is particularly vulnerable. If school records are in the system, students will find them. So they must be protected. But the security of the system Mr. Noah presented is illusory. It took me only a couple of hours to decode his message, and a competent student could probably do it in less time than that. I shall explain how I did it and present an alternate method.

There are two kinds of secret writing, codes and ciphers. In a code meanings are given to arbitrary symbols. For example, in 6800 assembly language the symbol TAB means copy the value found in register A into register B. If you don't know 6800 assembly language you can't interpret the symbols without a code book. That is the weakness of codes: somewhere there is a code book, retrieved from a Japanese submarine or stolen from an embassy safe in Italy, which compromises the code.

Substitution Ciphers

There are two kinds of ciphers: transposition and substitution. A transposition cipher moves the letters of a message around (transposes them) in accordance with a set pattern. A substitution cipher replaces letters with other letters or with symbols, again with a set pattern. It is clear that both of these methods are made for computers; it is perhaps not as clear that simple substitution ciphers are quite vulnerable to solution by computers.

In the sixteenth century a man named Porta published a book on natural magic and included in his work a section on secret writing. The example in Figure 1 shows how one of his methods, now named Vigenere after a later writer, works. As you see, a key word is written repeatedly above the message and each letter in the message is changed to its equal in the key alphabet. That is, the cipher letter is taken from the intersection of the message letter row and the key letter column.

Now, I have chosen a short keyword and a message limited to the first letters

David Block, P.O. Box 12473, Gainesville, FL 32604.

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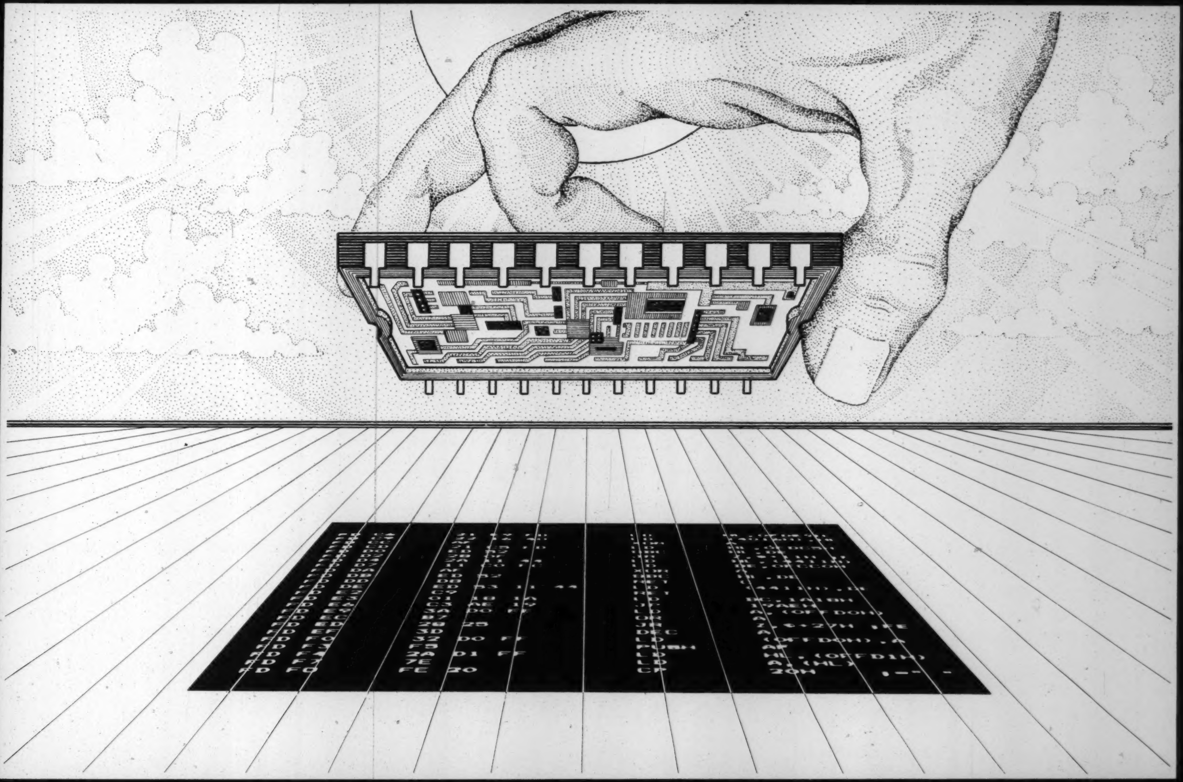

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of the alphabet to keep the table short. You will understand that the table can be extended both ways to make it practical. Notice that you don't need to keep a copy of the cipher. Whenever you need it, you simply reconstruct the table using the keyword or phrase agreed upon with the CIA, encipher your message, then burn the table and worksheet.

Given the cipher, how do you break it? First you determine the key length. Count the spacing between duplicate letters. In this short example we find that "I" follows "I" five letters later and "E" follows "E" five letters later. "B" follows "B" eight letters later. The odds are that the key is five letters long. In a longer example of this cipher we could find that repeated letters come more often ten or 15 letters later; the rule is that duplications are separated by a multiple of the key length.

Noah's method is a Vigenere cipher. If you examine his message you find that the repetitions show the key to be five units long. Using the method found in Helen Fouche Gaines' *Elementary Cryptanalysis*, arrange the message in five columns:

```
000 253 200 115 214
025 235 216 121 213
027 229 207 122 195
012 235 203 024 201
026 255 195 108 217
027 227 209 107 211
006 228 213 112 217
027 239 192 107 203
031 239 194 112 207
025 255 213 118 212
014 236 206 109 206
001 239 199 118 200
026 254 201 122 200
026 229 206 107 213
014 175 194 112 222
012 174 201 118 201
004 239 210 108 219
014 239
```

Notice the gratifying occurrence of duplicates in columns and particularly that every number in column one has zero as its first digit. We have been told that these numbers resulted from exclusive ORing decimal ASCII letter codes with key bytes. We know that the letters in each column were treated alike. The relative frequencies of the letters in English is dealt with in Poe's "The Gold Bug" and Sherlock Holmes story, "The Adventure of the Dancing Men." Since 239 occurs five times in column two, it is almost certainly "E." In decimal ASCII, "E" is 69. If 69 XOR KEY is 239, then 239 XOR 69 is KEY:

```
  E  0 1 0 0 0 1 0 1
239  1 1 1 0 1 1 1 1
key  1 0 1 0 1 0 1 0
```

The regularity of the key looks promising. At this point in the process I made an educated (and lucky) guess. I had written the following short program:

```
10 INPUT "KEY",X
20 INPUT "CODE",C
30 PRINT CHR$(C AND NOT X OR X AND NOT C)
40 GOTO 10
```

When I gave the key 10101010 (=170) to the program and plugged in the numbers from column two I found that the second letter of the message was "W." I guessed that this was the first letter of a verb. If

```
    key    Z  E B R  A Z E B  R A Z E B        a Z E B R A
message    a  b a d  d e e d  f a c e d        b A F C S B
 cipher    Z  F B U  D D I E  W A B I E        c B G D T C
                                               d C H E U D
                                               e D I F V E
                                               f E J G W F
```

Figure 1.

the CP/M* and S-100 user's journal

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Automatic centering	Yes	Yes
Custom form letters	Yes	Yes
Saves text or binary files	Yes	No
Flexible formatting	Yes	Yes
Supressed & continued page numbering	Yes	Yes
Hyphenation	No	Yes
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 LE DLHD EHVAE N HAERANAN HKO  SSHMORE  KETTOAAOET
```

Figure 2.

that was so, then the 000 of column one was an "I." I XOR 000 is 73. This key would explain why all of the numbers in column one begin with 0, since it is 00110001 as all ASCII codes are less than 10000000.

```
 10 OPEN "1.CODE" AS 1
 20 FIELD 1, 84*3 AS Z$
 30 FOR I=1 TO 84: PRINT I
 40 INPUT A$
 50 B$=B$+A$
 60 NEXT I
 70 LSET Z$=B$
 80 PUT 1, RECORD 1
 90 CLOSE 1
100 END
```

Listing 1.

At this point I created a file of the cipher numbers so I wouldn't have to enter them more than once while working on the problem. See Listing 1.

This is TSC's disk Basic. It created a disk file holding the first 252 digits of the message, to be handled by the program. See Listing 2.

Line 70, with the loop, picks out successive triplets of the requested column.

```
 20 OPEN "1.CODE" as 1
 30 GET 1, RECORD 1
 40 INPUT "Key",K
 50 INPUT "Column",L
 60 FOR I=0 TO 16
 70 FIELD 1, L+I*15 AS Z$,3 AS A$
 80 S=VAL(A$)
 90 M=S AND NOT K OR K AND NOT S
100 IF M)63 AND M(128 THEN PRINT CHR$(M);
    ELSE PRINT " ";
110 NEXT I
120 GOTO 40
```

Listing 2.

The triplet, which had been stored as a character string, is converted to a number by 80, XORed with the chosen key by 90, then printed by 100 if the result is a printable character. Running the first column with the key of 73 yielded the string IPRESRORVPGHSSGE. If the key had been wrong, we would likely have obtained a few blanks here. The result at this point, IW000PA00, suggests "I WILL P..." and led me to try 129 for column three, 31 for column four, and 154 for column five.

The cipher was broken. If it had not yielded at this point, I would have altered the last program to discard all keys for a column which resulted in any unprintable character. The relatively few possibilities which remained would not have taken long to assess. Combinations which gave the most pairs of TH, HE, and AN, along with the common triplets THE, AND, THA, and ENT, would have been looked for. See the book by Gaines for details.

Transposition Ciphers

Transposition ciphers are something else. If the letters of a common word are mixed up, resulting in EAPCITNE, some people will never discover what the word is. If a computer program is used to scramble the letters of a message in a prearranged way, the problem of deciphering looks formidable. The key is an agreed upon word or phrase:

```
  key    S E C U R I T Y
 order   5 2 1 7 4 3 6 8
         E A P C I T N E
         I S I T V A R U
         S P E S S O E S
         F D E W Y B E
```

The message has been written in eight-letter rows, putting the first letter under one, the second under two, etc. The message is recovered by reading in groups of eight letters, in the order indicated by the numbers derived from the key. So the first letter is P, the second A, etc. In practice, a longer key is used and the transmitted message is divided into five-letter groups to guard against letters lost in transmission making the rest of the message garbage.

The program in Listing 3 will accept a key and encipher a message. The main feature is the Shell sort, lines 90 to 230, which determines the order of the letters in the key. Line 60 has tagged each letter with its ordinal. The sort carries the ordinals along with the letters. Line 260 strips off the ordered ordinals and puts them into array B. If the ENCODE? of line 270 is answered with YES, the program determines the proper sequence for enciphering and requests a message. If the answer was NO, the program requests a cipher and will dicipher it.

In this simple program the key and message must be the same length. Strange things will happen if they are not. So choose a key shorter than the message and repeat it enough times that the two lengths match.

You are invited to alter the program to make the key repeat automatically, using something like

A=I-INT(I/N)*N+1

This simple transposition cipher is not secure. Again, Gaines explains how to attack the type. The keylength is determined by considering the distribution of the vowels and repetition of common two and three letter sequences. Another powerful tool is a search for probable words. You may like to try your hand on the example given in Figure 2. Be warned that the key is long and that spaces are significant.

Finally, a suggestion. Mr. Noah's method and mine may be combined. The resulting cipher would pose an interesting puzzle, although not an insoluble one. ☐

```
10 INPUT"TYPE KEYPHRASE AND PRESS RETURN.",K$
20 N=LEN(K$)
30 DIM X$(N),B(N),C(N)
40 FOR I=1 TO N
50 X$(I)=MID$(K$,I,1)+STR$(I)
60 NEXT I
70 L=N
80 L=INT(L/2)
90 IF L=0 THEN 240
100 J=1
110 K=N-L
120 I=J
130 M=I+L
140 IF X$(I)<X$(M) THEN 210
150 T$=X$(I)
160 X$(I)=X$(M)
170 X$(M)=T$
180 I=I-L
190 IF I<1 THEN 210
200 GOTO 130
210 J=J+1
220 IF J<=K THEN 120
230 GOTO 80
240 FOR I=1 TO N
250 B(I)=VAL(MID$(X$(I),2))
260 NEXT I
270 INPUT "ENCODE", E$
280 IF LEFT$(E$,1)="Y" THEN GOTO 350
290 INPUT "TYPE CIPHER AND PRESS RETURN",A$
300 FOR I=1 TO LEN(A$)
310 F=B(I)
320 PRINT MID$(A$,F,1);
330 NEXT I
340 END
350 FOR I=1 TO N
360 C(B(I))=I
370 NEXT I
380 INPUT "TYPE MESSAGE AND PRESS RETURN",A$
390 FOR I=1 TO LEN(A$)
400 PRINT MID$(A$,C(I),1);
410 IF I/5=INT(I/5) THEN PRINT " ";
420 NEXT I
430 END
```

Listing 3.

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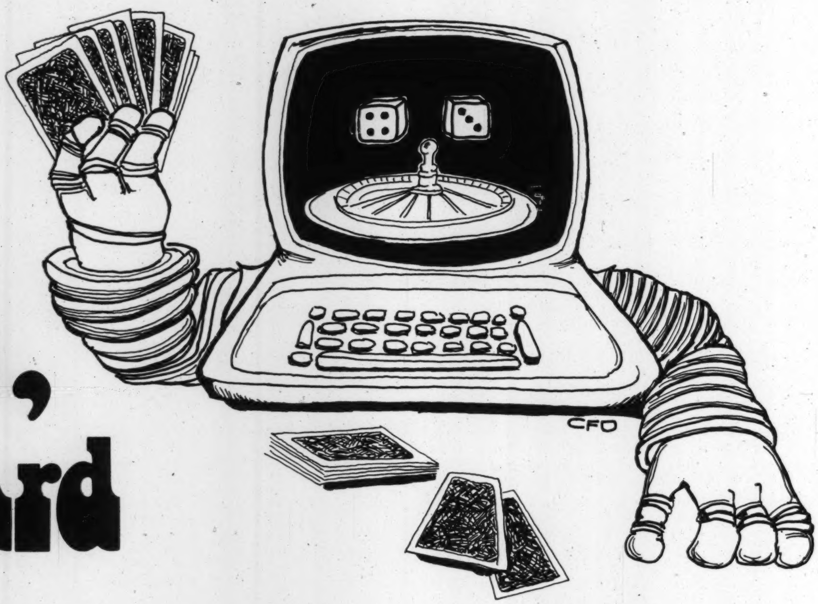

Edward Joyce

How can a computer simulate the roll of a die, the toss of a coin, or the spin of the roulette-wheel? Many computer applications require the simulation of these types of events, also known as random events or random observances. These applications include games, simulation models, and statistical analyses.

An efficient algorithm for generating random numbers is an essential part of these applications. This article describes the mixed congruential method for generating pseudorandom numbers and presents an implementation of it written in Z-80 assembler code.

A sequence of numbers is a random sequence if each successive number in the sequence has an equal probability of taking on any one of the possible values and is statistically independent of the other numbers in the sequence. An algorithm that generates a random sequence is called a random number generator.

Random number generators generate a sequence of random numbers from an initial random number called the seed. Since the sequence is always the same for a given seed, the numbers generated are predictable and reproducible. Therefore, the sequences generated by these algorithms are more correctly called pseudorandom sequences and the algorithm used is called a pseudorandom number generator.

The most commonly used pseudorandom number generator is the mixed congruential method. It generates a sequence of random numbers by always calculating the next random number from the last one obtained given an initial seed. The formula for the mixed congruential method is

$$x(n + 1) = ((a * x(n)) + c) \text{ modulo } m$$

where modulo is the remainder function. In other words, $x(n + 1)$ is the remainder of $((a * x(n)) + c)$ divided by m, and a, c, and m are positive integers, $a < m$, $c < m$. The possible values of $x(n + 1)$ are 0, 1, ... m - 1, so that m represents the desired number of different values that could be generated.

There are rules for choosing a and c that will guarantee that each number in the sequence occurs only once. For a binary computer with a word size of b bits, the usual choice for m is $m = 2**b$ because this is the total number of non-negative integers that can be expressed within the capacity of the word size (for a Z-80, b is 8). With this choice of m, the above property can be ensured by selecting any of the values $a = 1, 5, 9, 13 \ldots$ and $c = 1, 3, 5, 7, \ldots$.

The definition of random number generators and the description of the mixed congruential method is taken from Hillier and Lieberman, *Introduction to Operations Research* (Reference 1).

A property of the mixed congruential method is that the sequence of random numbers is repeated after m values are generated. Thus a new seed should be chosen after m values are generated to avoid repeating the same sequence.

The remaining question in this algorithm is the choice of the seed. Requiring the user to enter a seed to start the pseudorandom number generator may be inconvenient. It would be easier if the computer would choose this seed automatically.

Edward Joyce, 4603 Lyceum Dr., San Antonio, TX 78229.

A simple, direct way of doing this in an interactive program is to count the number of time units, say milliseconds, that it takes the user to answer a question. This count may then be used for the initial random seed. If the time unit is small enough, then the pseudorandom generator is to be used in a game program. Initially, the game program displays a set of instructions and prompts the user to "DEPRESS ENTER TO CONTINUE." While waiting for the user to depress enter, the program continually increments a register or variable. When enter is depressed, then register or variable may be used as the random seed.

(Another good source for a random number seed is the Z-80 refresh register. Use the command LD A, R to put this in register A.—Ed.)

Listing 1 shows the mixed congruential method implemented in Z-80 assembler code. In higher level languages such as Pascal and Basic, the formula for the mixed congruential method may be implemented in one statement. ☐

References

1. Hillier, F. S., and G. J. Lieberman, *Introduction to Operations Research*. San Francisco; Holden-Day, 1974.

```
001000                          ORG     1000H
                    * Generate a pseudorandom number between 0 and 255
                    .  using the mixed congruential method,
                    .
                    .          x(n + 1) = (((a * x(n)) + c) MOD m)
                    .
                    .  where a = 21, c = 13, and m = 256, thus the formula is
                    .
                    .          x(n + 1) = (((21 * x(n)) + 13) MOD 256)
                    .
                    .
                    .
                    .  Entry:
                    .    register A = x(n)
                    .
                    .  Exit:
                    .    register A = x(n + 1)
                    .    register B = x(n) * 4
                    .    register C = x(n)
                    .    all other registers unchanged
                    .
                    .
                    .
                    * Calculate 21*x(n) using the identity
                    .  21*x(n) = 1*x(n) + 4*x(n) + 16*x(n)
001000   4F         GENRAND   LD      C,A      C <- 1*x(n)
                    .
001001   CB 27                SLA     A        B <- 4*x(n)
001003   CB 27                SLA     A
001005   47                   LD      B,A
                    .
001006   CB 27                SLA     A        A <- 16*x(n)
001008   CB 27                SLA     A
                    .
00100A   80                   ADD     A,B      A <- 20*x(n) = 16*x(n) + 4*x(n)
00100B   81                   ADD     A,C      A <- 21*x(n) = 20*x(n) + 1*x(n)
                    .
                    .
                    .
00100C   C6 0D                ADD     A,13D    A <- ((21*x(n)) + 13) MOD 256
00100E   C9                   RET
                              END
```

Listing 1. Z-80 code for mixed congruential pseudorandom number generator.

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CIRCLE 123 ON READER SERVICE CARD

Reading and Writing Sorcerer Strings

Bob Stuckmeyer

My experience with the Sorcerer can best be described as a bittersweet love affair. Make no mistake, I am definitely crazy about the machine—but occasionally (in an emotional frenzy) I have threatened to terminate the relationship. In all fairness to the folks at Exidy I will describe what is good about their product before discussing what is not so good and how in one instance I was able to circumvent a design flaw.

The hardware quality of the Sorcerer is excellent; my unit has worked reliably from day one. The keyboard has a professional feel and includes a numeric keypad. The use of plug-in ROM software packs was an idea, pioneered by Exidy, which has since been used by Texas Instruments and Atari. The Sorcerer video display of 30 lines of 64 characters (upper and lower case) is far better than that offered on competing systems from Apple, Atari, Radio Shack or TI.

My major complaints concern the 8K Microsoft Basic plug-in ROM that is supplied with the standard Sorcerer. Exidy has advertised their product as a machine that is "all business." Unfortunately standard Basic has several weaknesses which make it difficult to support a small business application.

One severe weakness is that standard Basic only supports decimal numbers having six significant digits. This implies that dollar amounts greater than $9999.99 cannot be manipulated accurately. The only advice I can give to get around this limitation is to write in assembly language or buy a disk system which comes with extended Basic.

Only numeric data can be written to and read from cassette; I/O of character strings is not supported.

Standard Basic is also deficient in its handling of cassette I/O. Only numeric data can be written to and read from cassette; I/O of character strings is not supported. Moreover, the Basic cassette I/O routines do not work reliably at the normal transfer rate of 1200 baud; a slower transfer rate of 300 baud must be used.

Because my intended uses for the Sorcerer rely heavily on the manipulation and storage of character data, deficiencies in cassette I/O posed serious problems. Obvious solutions were to buy a disk system or to write in assembly language. I rejected the former due to expense and the latter because of the programming effort involved. Another alternative is to convert character data to its numeric ASCII equivalent prior to writing to cassette and to perform an inverse transformation when reading. Because numbers occupy four bytes of memory while characters occupy a single byte, this approach increases the amount of data stored by a factor of four. As mentioned previously, the transfer rate must also be reduced from 1200 to 300 baud for this technique to work. Needless to say this alternative proved to be too inefficient for my needs—I was writing four times as much data four times as slowly.

After much frustration the obvious finally occurred to me. Why not access the monitor routines for cassette I/O? Unlike their Basic counterparts these routines work quite reliably at 1200 baud. Because they operate based on a range of specified memory addresses the monitor routines are oblivious to the type of data contained in the range; hence, they work equally well on character or numeric data.

To access the monitor routines from a Basic program I had to write two short

---

Bob Stuckmeyer, 2347 Cavendish Lane, St. Louis, MO 63129.

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CIRCLE 252 ON READER SERVICE CARD

Sorcerer, continued...

assembler subroutines that could be called via the Basic USR function. These subroutines are contained in Listing 1.

Listing 1.

```
EXIDY Z-80 ASSEMBLER
   ADDR  OBJECT     ST #

                    0001 ;        SORCERER BASIC CASSETTE I/O INTERFACE
                    0002 ;                        BY
                    0003 ;                   BOB STUCKMEYER
                    0004 ;                   2347 CAVENDISH LANE
                    0005 ;                   ST. LOUIS, MO  63129
                    0006 ;                       06/20/80
                    0007 ;*******************************************
                    0008 ;
                    0009 ;        EXIDY MONITOR SUBROUTINE ADDRESSES
                    0010 ;
  >E02A             0011 TAPSAV  EQU     0E02AH          ;SAVES MEM ON TAPE
  >E02D             0012 TAPLOAD EQU     0E02DH          ;LOADS A FILE INTO MEM
  >E1A2             0013 GETMWA  EQU     0E1A2H          ;PLACES MWA ADDR IN IY
                    0014 ;
                    0015         PSECT   ABS
                    0016         ORG     00AAH
                    0017 ;
                    0018 ;       SAVE RECORD ON TAPE
                    0019 ;
  00AA  E5          0020         PUSH    HL              ;WE DESTROY
  00AB  FDE5        0021         PUSH    IY
  00AD  D5          0022         PUSH    DE
  00AE  CDA2E1      0023         CALL    GETMWA
  00B1  FD365000    0024         LD      (IY+50H),0      ;LOAD MWA+50, MWA+51 WITH

  00B5  FD365100    0025         LD      (IY+51H),0      ; SAVE START ADDRESS
  00B9  21DF00      0026         LD      HL,SAVRET       ;PUT RETURN ADDR ON STACK

  00BC  E5          0027         PUSH    HL
  00BD  210000      0028         LD      HL,00H          ;PUT SAVE START ADDR ON
  00C0  E5          0029         PUSH    HL              ; STACK
  00C1  ED5BFE00    0030         LD      DE,(ENDAD)      ;LOAD SAVE END ADDRESS
  00C5  21FC00      0031         LD      HL,CR           ;POINT HL AT CARR RET
  00C8  FD364752    0032         LD      (IY+47H),'R'    ;LOAD MWA+47 - MWA+4B
  00CC  FD364845    0033         LD      (IY+48H),'E'    ; WITH ASCII FILE NAME
  00D0  FD364943    0034         LD      (IY+49H),'C'
  00D4  FD364A52    0035         LD      (IY+4AH),'R'
  00D8  FD364B44    0036         LD      (IY+4BH),'D'
  00DC  C32AE0      0037         JP      TAPSAV          ;WRITE RECORD
  00DF  D1          0038 SAVRET  POP     DE              ;RESTORE
  00E0  FDE1        0039         POP     IY
  00E2  E1          0040         POP     HL
  00E3  C9          0041         RET
                    0042 ;
                    0043 ;       LOAD RECORD FROM TAPE
                    0044 ;
  00E4  E5          0045         PUSH    HL              ;WE DESTROY
  00E5  FDE5        0046         PUSH    IY
  00E7  F5          0047         PUSH    AF
  00E8  CDA2E1      0048         CALL    GETMWA
  00EB  21F700      0049         LD      HL,LODRET       ;PUT RETURN ADDR ON STACK

  00EE  E5          0050         PUSH    HL
  00EF  AF          0051         XOR     A               ;ZERO A
  00F0  FE01        0052         CP      1H              ;SET NZ FLAG
  00F2  F5          0053         PUSH    AF              ;PUT FLAG ON STACK
  00F3  AF          0054         XOR     A               ;SET Z FLAG




  00F4  C32DE0      0055         JP      TAPLOAD         ;READ RECORD
  00F7  F1          0056 LODRET  POP     AF              ;RESTORE REGISTERS
  00F8  FDE1        0057         POP     IY
  00FA  E1          0058         POP     HL
  00FB  C9          0059         RET
                    0060 ;
                    0061 ;       WORK AREAS
                    0062 ;
  00FC  0D          0063 CR      DEFB    0DH
  00FD  0D          0064         DEFB    0DH
  00FE  0000        0065 ENDAD   DEFW    00H
ERRORS=0000

CR            00FC ENDAD        00FE GETMWA      E1A2
LODRET        00F7 SAVRET       00DF TAPLOA      E02D
TAPSAV        E02A
```

Before discussing how these routines work let's talk about how Basic interfaces with a machine language subroutine. Machine language routines are generally placed in the first 256 bytes of memory because this is the only area of available RAM that you can be assured Basic won't clobber. Prior to calling a machine language routine from Basic, the routine must be loaded in memory and the starting address must be POKEd into decimal addresses 260 and 261 (low order byte, then high order byte). The routine may then be called with the USR function.

Listing 1 contains two subroutines: one for saving data on cassette and one for loading data from cassette. Both routines operate under the assumption that the Sorcerer controls your cassette on/off motors (Exidy sells a special cable that allows connection to dual cassettes plus on/off motor control). The first 170 bytes of RAM (decimal addresses 0-169) are used as the cassette data buffer.

Prior to calling the SAVE routine the Basic program must move the data to be written into the buffer, then POKE the number of bytes to be saved into decimal address 254. The program must also tell the subroutine which cassette to use by POKEing the appropriate value into decimal address 252 (to select cassette 1 use 49, to select 2 use 50). The SAVE routine uses this information to establish the proper linkage for calling the monitor routine which writes memory to cassette.

Why not access the monitor routines for cassette I/O?

The LOAD routine assumes that data will be read from cassette 1. Data read from tape is placed in the buffer. The Basic program can then move this data to the appropriate variable(s) for further processing.

Listing 2 is a Basic program which demonstrates use of these routines by writing character strings to cassette and reading them back. Note that each string written to tape is followed by at least one special character (hex zero). This character is used by the Basic program to determine where the string ends in the buffer when data is read.

This approach for cassette I/O has worked well for me in a word processor I have written. The routines can also be used to save multiple strings at a time (i.e. to save a customer name and address as one record) if care is taken so that the total length of the data to be saved does not exceed the maximum length of the buffer and if each string is delimited with an end-of-string character. Strings and numeric variables can also be saved on a single record if the number is first converted to a string using the STR$ function and then converted back to a number when it is read back in using the VAL function. ☐

Listing 2.

```
10 REM ** DEMO PROGRAM FOR READING AND WRITING **
20 REM ** STRING DATA TO CASSETTE              **
30 REM **               BY                     **
40 REM **           BOB STUCKMEYER             **
50 REM **           2347 CAVENDISH LN          **
60 REM **           ST LOUIS, MO  63129        **
70 REM **              6/20/80                 **
100 CLEAR 500:DIM A$(7)
105 REM   FOLLOWING TEXT FROM J.R.R. TOLKIEN'S
107 REM   THE LORD OF THE RINGS
110 A$(0)="Three Rings for the Elven-Kings under the sky,"
120 A$(1)="Seven for the Dwarf-lords in their halls of stone,"
130 A$(2)="Nine for Mortal Men doomed to die,"
140 A$(3)="One for the Dark Lord on his dark throne"
150 A$(4)="In the Land of Mordor where the Shadows lie."
160 A$(5)="One Ring to rule them all, One Ring to find them,"
170 A$(6)="One Ring to bring them all and in the "
175 A$(6)=A$(6)+"darkness bind them"
180 A$(7)="In the Land of Mordor where the Shadows lie."
190 GOSUB 1000:REM LOAD CASSETTE I/O ROUTINES
200 GOSUB 2000:REM WRITE TO CASSETTE
210 GOSUB 3000:REM READ FROM CASSETTE
220 REM  DISPLAY TEXT
230 PRINT CHR$(12):REM CLEAR SCREEN
240 FOR I=0 TO 7:PRINT A$(I):NEXT I
250 END
1000 REM ** THIS ROUTINE LOADS THE MACHINE LANGUAGE **
1010 REM ** CASSETTE I/O ROUTINES                   **
1020 FOR I=170 TO 255
1030 READ K:POKE I,K
1040 NEXT I
1045 DATA 229,253,229,213,205,162,225
1050 DATA 253,54,80,0,253,54,81,0,33,223,0
1060 DATA 229,33,0,0,229,237,91,254,0,33,252,0,253,54,71,82
1070 DATA 253,54,72,69,253,54,73,67,253,54,74,82
1080 DATA 253,54,75,68,195,42,224,209,253,225,225,201
1085 DATA 229,253,229,245,205,162,225,33,247,0
1090 DATA 229,175,254,1,245,175,195,45,224,241,253,225
1100 DATA 225,201,13,13,0,0
1110 RETURN
2000 REM ** THIS ROUTINE WRITES STRING DATA TO CASSETTE **
2010 REM
2015 REM  SET MAX STRING LENGTH TO 64
2020 POKE 254,65
2022 REM  SELECT CASSETTE #1 TO WRITE
2023 POKE 252,49
2025 REM  SET UP USR CALL
2030 POKE 260,170:POKE 261,0
2035 REM
2040 PRINT CHR$(12);"Ready cassette #";PEEK(252)-48;
2042 PRINT " for recording,"
2050 INPUT "press RETURN to start";Z$
2060 FOR I=0 TO 7
2070 REM  CLEAR DATA BUFFER
2080 FOR J=0 TO PEEK(254):POKE J,0:NEXT J
2090 REM  LOAD STRING INTO BUFFER A CHARACTER AT A TIME
2100 FOR J=1 TO LEN(A$(I))
2110 POKE J-1,ASC(MID$(A$(I),J,1))
2120 NEXT J
2130 REM  WRITE BUFFER TO TAPE
2140 X=USR(0)
2150 NEXT I
2160 RETURN
3000 REM ** THIS ROUTINE READS DATA FROM CASSETTE **
3020 REM
3030 REM  SET UP USR CALL
3040 POKE 260,228:POKE 261,0
3050 REM
3060 PRINT CHR$(12);"Rewind cassette # 1, press play,"
3070 INPUT "then press RETURN";Z$
3080 FOR I=0 TO 7
3090 REM  READ RECORD INTO BUFFER
3100 X=USR(0)
3110 REM  LOAD STRING FROM BUFFER A CHARACTER AT A TIME
3120 A$(I)=""
3130 FOR J=0 TO PEEK(254)
3140 REM  CHECK FOR END OF STRING CHARACTER (HEX 0)
3150 IF PEEK(J)=0 THEN 3180
3160 A$(I)=A$(I)+CHR$(PEEK(J))
3170 NEXT J
3180 NEXT I
3190 RETURN
READY
```

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Computerized Star Map

Andrew Shooman

An astronomer needs a star map just as a traveler needs a road map. He must know where to look for celestial objects and be able to predict their position in the future. Many astronomers use a star map, consisting of two disks, which can be rotated to represent any sky position for a particular latitude on earth.

This program is written for the 16K Level II TRS-80. It prints a computerized star map, which uses various mathematical formulae for computing the positions of the stars and the moon, and for displaying them on the computer terminal.

The Mechanical Star Map

A star map is a mechanical device which consists of two rotatable concentric disks. The disk underneath has all the stars ever visible in your hemisphere printed on it, while the upper disk has a hole cut out which represents a view of the sky. One disk has the dates of the year printed near the outside rim, while the other has the time of the day printed in the same position. When the appropriate date and time are matched up along the scales, the stars which appear through the cutout represent the actual sky.

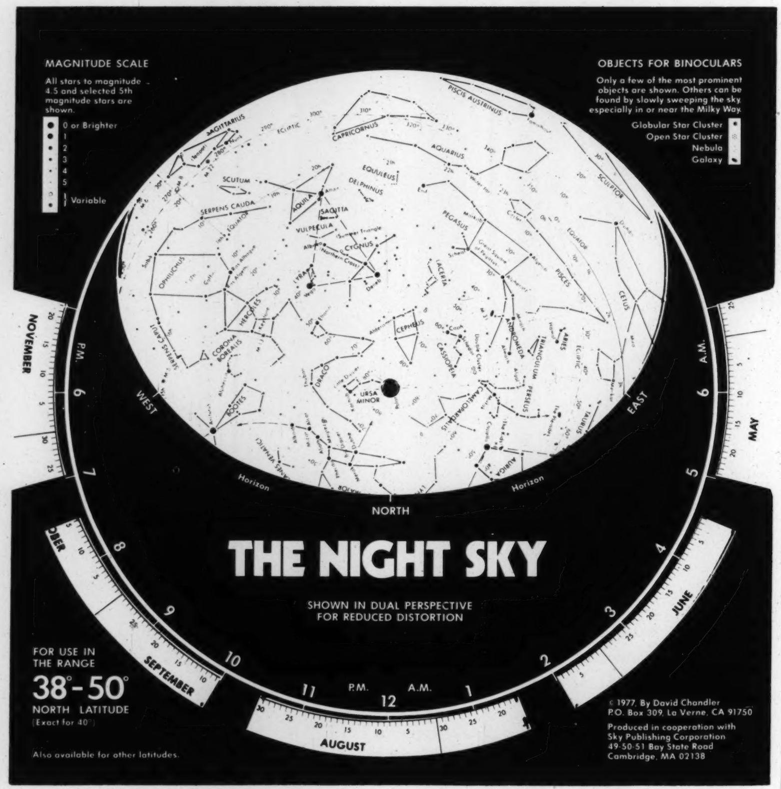
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Figure 1. Rotatable Star Map.

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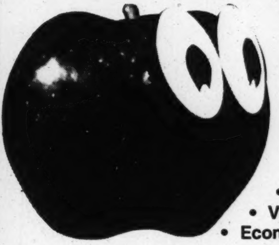

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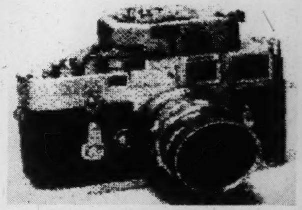

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A rotatable star map is needed because of the apparent westward motion of the stars due, of course, to the earth's eastward rotation and revolution. The scales for date and time, in fact, relate to the motion of the earth, thereby predicting the position of the stars.

From a particular location on earth, some stars will be visible and some will never be visible. The majority, however, are visible sometimes. The ones which can always be seen are called circumpolar, because they appear to circle the pole. The constellations which are circumpolar from New York are: Ursa Major (which includes the Big Dipper), Ursa Minor (the Little Dipper), Draco, Cepheus and Cassiopeia. By rotating a star map through all the possible positions, one can determine when any given star is visible.

To understand the program, it will be necessary to cover some relevant astronomical background and terminology.

Cities on the globe of the world are located by coordinates of latitude and longitude. Stars are located in the globe of the sky by coordinates of *right ascension* (heavenly longitude) and *declination* (heavenly latitude). Right ascension can be measured in degrees or hours and minutes.

The right ascension, or longitude in the sky, of a star is constantly changing as the earth turns; but its declination or latitude in the sky, is always the same (Figure 2).

The hour angle describes star positions in relation to the meridian. An hour angle of a star increases by 15 degrees each hour, while its declination always remains constant. This coordinate of the star, can be used to plot the star on a star map, or to locate its position in a particular sky.

For everyday viewing purposes, we may think of the globe of the sky as rotating around the globe of the earth. Each star has a particular highest moment, its *transit*, which is the time that it crosses the *meridian*—an imaginary line bisecting the sky which runs directly from north to south.

Every star transits about four minutes, actually three minutes and fifty-five seconds. This adds up to two hours earlier each month, and 24 hours earlier the next year. For instance, if a star transits at 9:00 p.m. one night, it will transit at 8:56 p.m. the next night.

Since 24 hours is one day, the stars cross the meridian at the same time of day one year later. (This is because the earth rotates once more per year with respect to the stars than it does with respect to the sun.—*Ed.*) This program uses a more exact factor of about 3 minutes and 56 seconds a day.

Sidereal time is what we call the time that measures the apparent motion of the stars. It is measured in slightly shortened days, hours and minutes. Clock time and sidereal time are the same on September 23. The next day at arbitrary(?) or solar midnight, sidereal time is about 23 hours and 56 minutes. Sidereal time thus corresponds to the transit time of the stars. When sidereal time is the same as the right ascension of a given star, that star will be on the meridian.

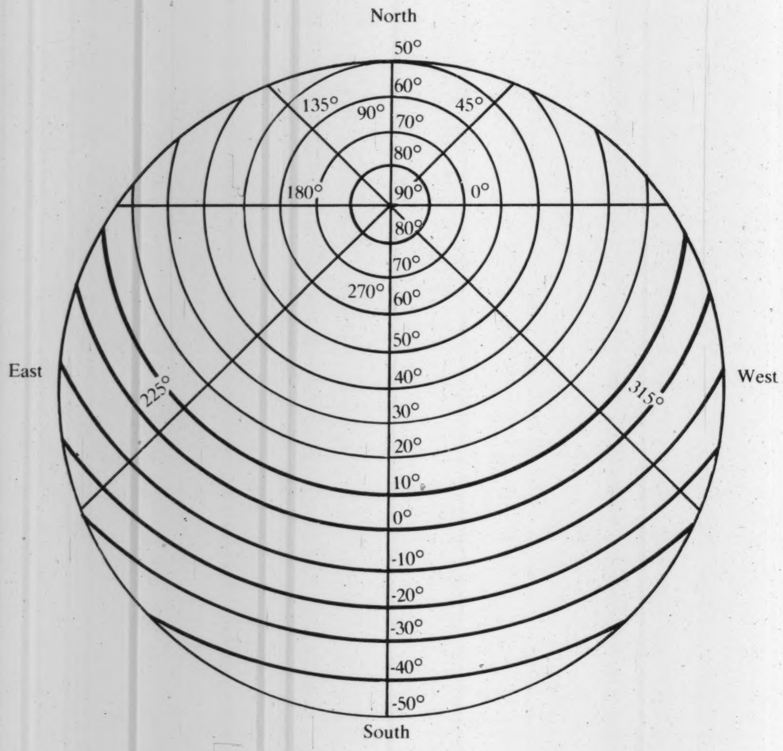

Figure 2. Hour Angle and Declination Coordinate System.

The program prints the positions not of individual stars, but of the major constellations with respect to the meridian.

Sidereal time, like right ascension, can be expressed either in degrees or from 0 to 24 hours. This program does all computations in degrees since it is more convenient, but later converts to hours and minutes, the more common system among astronomers.

The program prints the positions not of individual stars, but of the major constellations with respect to the meridian; the star map would be too crowded to print each individual star.

Phases of The Moon

The phase of the moon—its illuminated shape as seen from earth—changes as the moon moves along its orbit around the earth. This takes about 29 1/2 days to complete. The *moon's age* is a number stating its phase precisely.

Since only the half of the moon which faces the sun reflects sunlight, the phase depends on how much of the lighted part of the moon can be seen from earth. At one point in its orbit, we can see only the dark side of the moon (See Figure 3.) This phase is called "new moon." As the moon progresses in its orbit we can gradually see more of the lighted moon, which grows

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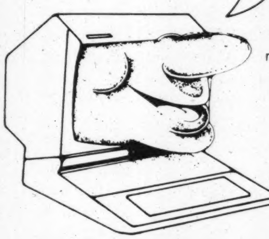

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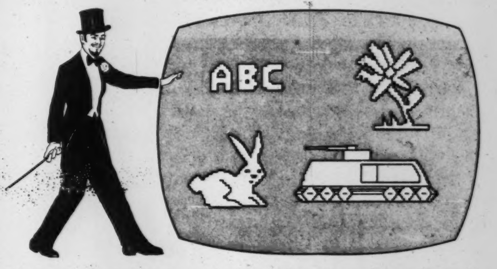

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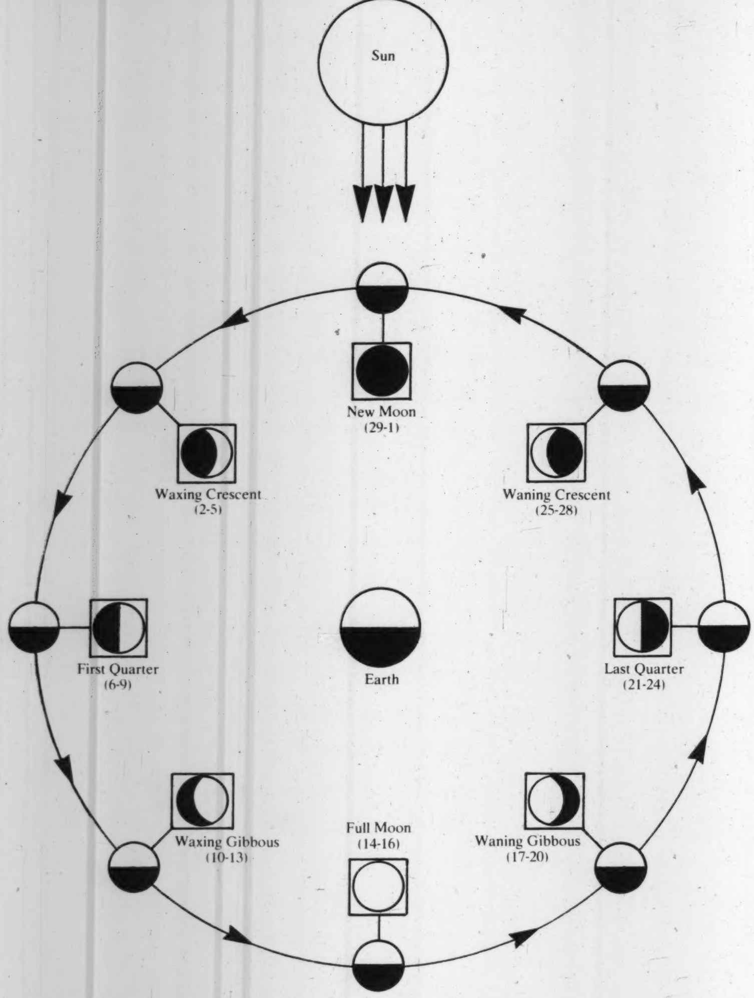

Figure 3. Phases of the Moon. (Boxes indicate view of the moon from earth, numbers represent moon's age.)

from crescent to gibbous (more than half, or football shaped), until we can see all of the lighted part of the moon during the phase called "full moon."

Then as the moon continues in its orbit, we can see less of the lighted moon, as the phase changes from full moon to gibbous to last quarter to crescent back to new moon, and the cycle repeats itself. The moon's age is thus the number of days since the new moon. The term "waxing" refers to the period when the moon appears to grow larger when we gradually see more of the lighted moon each day, and "waning" to the other period. (This program represents each phase of the moon with a picture printed with a 5 x 5 matrix of X's.)

Because of the cyclical nature of the star map, this program uses the modulo function repeatedly. The modulo function for values A and B assigns a new value to A in the range from 0 to almost B, by subtracting all the multiples of B. In the computer language PL/1, this is a built-in function. However, in Basic this must be defined by the following statement:

```
DEF FNM (A,B)=(A/B-INT(A/B)*B
```

where DEF announces user-defined functions, FNM is the name we give the modulo function, and INT is the built-in integer function (which truncates numbers to integers).

For example, the modulo of (47,30) is 17, the modulo of (700,360) is 340, and the modulo of (15,25) is 15. But we often use this function for non-integer values—for instance, to furnish values of sidereal time or right ascension between 0 and 360 degrees.

The following is the formula for the computation of sidereal time:

```
S=FNM((D+K)*F+T1,360)
```

where FNM is the modulo function, D is the number of days since the beginning of the current year, K is a constant which equals the number of days from the zero point of sidereal time (September 23) until the end of the year (99 days), F is the factor by which sidereal time changes each day (0.98630137 degrees), and T1 is the motion of the star since midnight of the current day. S is given in degrees.

The formula used to compute hour angle is:

```
H=FNM(S-R1+K,360)
```

where FNM is the modulo function, H is the hour angle in degrees, S is the sidereal time in degrees, R1 is the right ascension in degrees, and K is the angular value of the meridian (270 degrees) in this coordinate system.

The coordinate system used in this program is referenced from the north pole and uses west (the positive X-axis, which is 0 degrees) for the angular reference point.

Cartesian Output from Polar Data

This program must convert polar coordinates to Cartesian coordinates (see Figure 5) because the positions of the stars are stored in the polar system, but the average computer terminal can print only horizontally and vertically. The fact that an average computer terminal cannot print upward by reversing the paper poses a problem, because the constellations must be printed on the star map from top to bottom and from left to right.

Back and forth problems are overcome by storing all of the positions in a matrix, and then printing out the matrix one row at a time. The X and Y values obtained from the coordinate conversions must also be offset by the values of the radius of the circle (which is the outline for the star map) plus 1, to prevent negative values from entering the matrix, which generates an error in Basic Plus.

The following formulae convert polar coordinates to Cartesian coordinates and offset them for entrance into the matrix:

```
X=INT(R*COS(T*C)+.5)+R2=1
Y=INT(R*SIN(T*C)+.5)+R2+1+
    (90-L)/90*R2
```

where INT is the integer function, R is the radius of declination circle (in characters), T is the hour angle (theta value), C is a correction factor from degrees to radians (polar coordinates are in degrees, but the computer performs trigonometric operations only in radians) which equals 0.0174533; R2 sets the radius of a circle outlining the star map; and L is the latitude for the star map (40 degrees for New York). (The Y coordinate must be offset to adjust for the proper latitude.)

Visibility

The positions of the constellations must be checked and those outside the visible circle are excluded from the matrix. The following inequality will produce only those points outside the circle:

$(X-A)^2 + (Y-B)^2 > R^2$

where (A,B) is the center of the circle, and R is the radius of the circle. This can be adapted to our circle and be implemented in the computer programs as the following IF statement, which stores the point in the matrix only if the statement is false:

```
IF (X-R2-1) ↑ 2+(Y-R2-1) ↑ 2>R2 ↑ 2
```

where (R2+1,R2+1) is the center of the circle, and R2 is the radius.

The circle which is the boundary for the visible sky is entered into the matrix by assigning the R value in the polar coordinate system to the radius of the circle (R2), and by assigning the T (theta) value to 22.5 degrees (16 total) intervals around the circle. Then these values are passed to the coordinate conversion subroutine and the Y coordinate is not adjusted for latitude, since the visible circle remains in the same matrix location under any conditions.

The Ecliptic

The ecliptic is an imaginary band in the sky along which the sun, moon, and planets appear to travel. When the right ascension of the ecliptic is plotted against the declination, it forms a sine curve (Figure 4). This means that when we are given the right ascension of an object on the ecliptic, we can find its declination by multiplying the sine of its right ascension by 23.5 degrees (the declination of the crest of the sine curve).

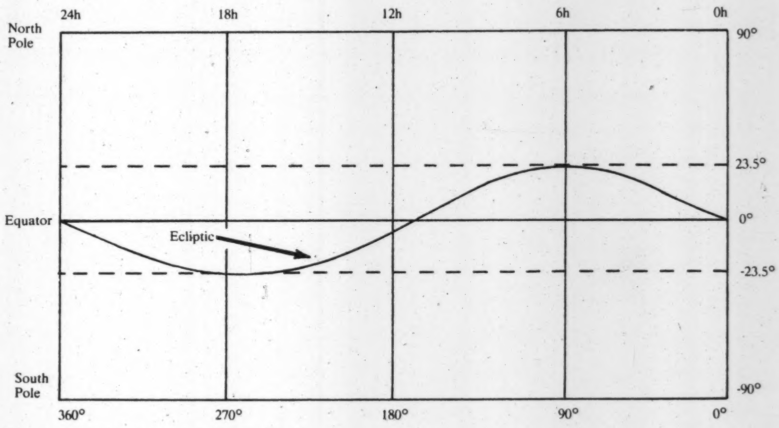

Figure 4. Definition of the Ecliptic.

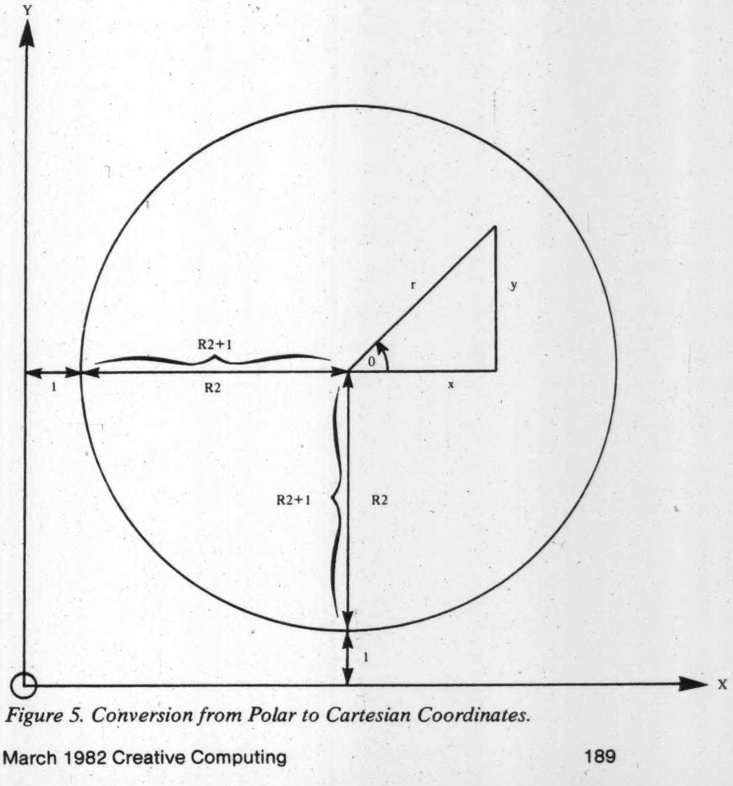

Figure 5. Conversion from Polar to Cartesian Coordinates.

The ecliptic is an imaginary band in the sky along which the sun, moon, and planets appear to travel.

Here is the formula for declination of the ecliptic:

D=SIN(R*C)*23.5

D is the declination, R is the right ascension, and C is the correction factor (from degrees to radians).

Position of the Sun

The position of the sun is used to inform the user that no stars are visible if a daytime hour is inputted, by printing the sun directly on the star map. It is also used to find the position of the moon.

The sun appears to move 360 degrees in relation to the other stars each year. If we divide 360 degrees by 365 days, we get the number of degrees the sun appears to move each day. From this and other information, omitted here, we can derive this formula for the right ascension of the sun:

S1=FNM((D+T1/360)*F+281.1,360)

where FNM is the modulo function, S1 is the right ascension of the sun, D is the days since the beginning of the year, T1 is the fraction of the day which has already passed (a number between 0 and 360 degrees), and F is the number of degrees the sun appears to move each day (0.98630137 degrees).

The Moon's Age

The moon's age is 0 at the beginning of every month and cycles accordingly. The moon's age formula, like the others, is derived from a number of sources and some calculation. An approximate formula and table in *Earth, Moon, and Planets*[1] provided the information that the phases of the moon, (which are directly relative to the moon's age), repeat on a 19-year cycle. For example, the moon's age on January 1, 1976 was the same as it will be on January 1, 1995.

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[1] Whipple, Fred, *Earth, Moon, and Planets*, Harvard University Press, Cambridge, 1968, p. 282.

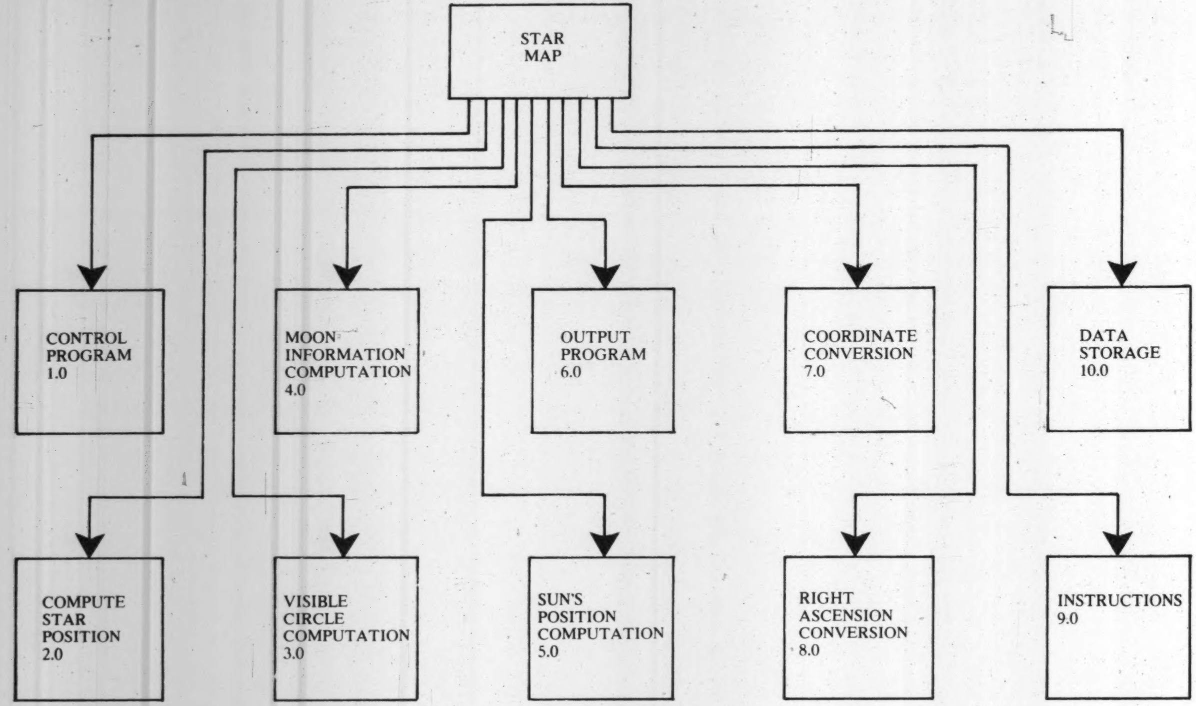
STAR MAP
CONTROL PROGRAM 1.0
MOON INFORMATION COMPUTATION 4.0
OUTPUT PROGRAM 6.0
COORDINATE CONVERSION 7.0
DATA STORAGE 10.0
COMPUTE STAR POSITION 2.0
VISIBLE CIRCLE COMPUTATION 3.0
SUN'S POSITION COMPUTATION 5.0
RIGHT ASCENSION CONVERSION 8.0
INSTRUCTIONS 9.0

Figure 6. Hierarchy Diagram.

I was able to obtain the moon's age for January 1, 1977 (rounded to one decimal place) from the 1977 edition of the *The Observer's Handbook*[2]. This information led me by various means to the moon's age formula given below:

A=FNM(FNM(Y1,19)*
10.875+28.9+d+T1/360,LO)

where FNM is the modulo function, Y1 is the year, D is the days since the beginning of the year, T1 is the stars' motion (in degrees) since midnight of the current day and L0 is the length of the lunar month (29.5306 days).

Position of the Moon

The position of the moon relative to earth is affected by three factors: the position of the earth in its orbit around the sun (which can be determined by the sun's position from earth), the position of the moon in its orbit around the earth (which can be determined by the moon's age), and the nodes of the moon (which cause approximately a five degree deviation of the moon from the ecliptic, due to the eccentricity of its orbit around the earth). This also has a slight effect on the change in right ascension of the moon.

I use a lunar formula for the right ascension of the moon based on the first two factors. It has an accuracy of about 4 1/6%. The moon's nodes were excluded from the formula because of the complexity of Kepler's Laws of Planetary Motion, which would have had to be considered.

"Top-down" design, emphasizes the use of a control structure from the early stages.

During one lunar month, the moon moves 360 degrees in relation to the sun. If we divide 360 degrees by 29.5306 days (the length of a lunar month), we get 12.1907 degrees, the average daily change of the right ascension of the moon. Given the right ascension of the sun from the previous formula, we can devise this formula for the right ascension of the moon.

R3=FNM(A*12.1907+S1,360)

where FNM is the modulo function, R3 is the right ascension of the moon, A is the moon's age, and S1 is the right ascension of the sun.

Using the formula for declination of the ecliptic, we can find the declination of the moon and plot it on the star map just as we would for a star.

Conversion to Hours and Minutes

As previously mentioned, right ascension can be measured in degrees or hours and minutes. This program calculates in degrees but later converts to hours and minutes for the output using these formulae:

HO=FNM(INT(DO/15),24)
MO=INT((DO/15-INT(DO/15))*60)

where FNM is the modulo function, HO is the right ascension in hours, MO is the right ascension in minutes, and DO is the right ascension in degrees.

Top Down Modular Design

When writing a computer program, there are basically two methods of design. The first one, called "top-down" design, emphasizes the use of a control structure from the early stages. Much of the early stage is devoted to planning and designing the specifications, and the breaking down of long processes into smaller ones which can be tackled more easily. Once these functions are broken down into small enough groups, each group is coded (into computer language) separately.

The second method of design, called "bottom-up," focuses the priority on the crucial parts of the program as determined by the programmer. These are of an

---

[2] Percy, John R., ed., *The Observer's Handbook 1977*, Royal Astronomical Society of Canada, Toronto, 1977, p. 36.

Apple

Software for Elementary Schools

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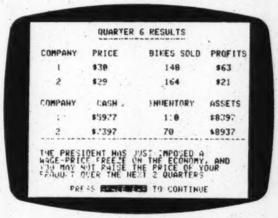
All MECC software is on disk and requires 32K Applesoft in ROM and Dos 3.3. All except MECC 720 and MECC 724 are copy protected. Damaged copy protected disks will be replaced with the return of the original and a $5 handling charge.

MECC-701 Apple Demonstration Diskette
This is a sample of the applications available on the MECC diskettes. It includes demonstrations in drill and practice, tutorial, simulation, problem solving and worksheet generation. Samples from music, science, social studies, industrial arts, reading, and mathematics are provided. $19.95.

MECC-702 Elementary, Volume 1 Mathematics
These are programs for the elementary mathematics classroom. Included are games of logic such as "Bagels", "Taxman" and "Number"; drill and practice programs such as "Speed Drill", "Round" and "Change"; and programs about the metric system such as "Metric Estimate", "Metric Length" and "Metric 21". $24.95.

MECC-703 Elementary, Volume 2 Language Arts
In this package are the programs "Spell", which drills students in spelling; "Mixup", which presents words in mixed up order, and "Word Find", which creates a word find puzzle for the teacher to duplicate. If words and definitions are entered, a "Cross Word" puzzle can be generated or a "Word Game" can be played. "Talk" is a program designed to introduce students to the computer and "Amazing" prints out worksheet mazes. $24.95.



```
QUARTER 6 RESULTS

COMPANY   PRICE      BIKES SOLD  PROFITS
   1      $30          148        $63
   2      $29          164        $21

COMPANY   CASH       INVENTORY   ASSETS
   1      $5977        110        $8397
   2      $7397        70         $8937
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THE PRESIDENT HAS JUST IMPOSED A
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PRODUCT OVER THE NEXT 2 QUARTERS

      PRESS [illegible] TO CONTINUE
```

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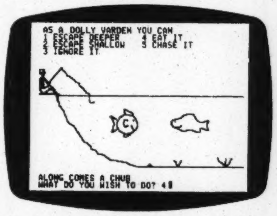
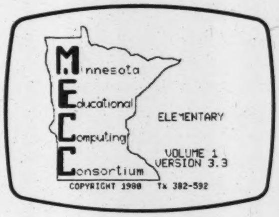


```
AS A DOLLY VARDEN YOU CAN
1 ESCAPE DEEPER     4 EAT IT
2 ESCAPE SHALLOW    5 CHASE IT
3 IGNORE IT

ALONG COMES A CHUB
WHAT DO YOU WISH TO DO? 4
```

MECC-705 Elementary, Volume 4 Mathematics and Science
Two mathematics programs, "Estimate" and "Mathgame", provide reinforcement on estimating and basic facts. Food chains in fish and animals can be studied through "Odell Lake" and "Odell Woods". "Solar Distance" teaches the concepts of distances in space and "Ursa" is a tutorial on constellations. $24.95



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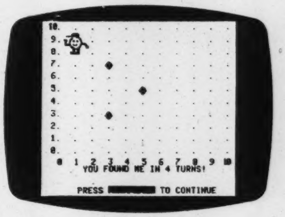

```
YOU FOUND ME IN 4 TURNS!

PRESS [illegible] TO CONTINUE
```

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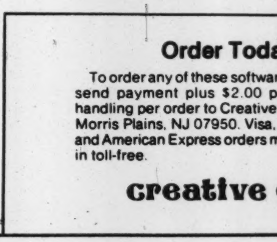

```
THAT'S RIGHT ST. PAUL, MINNESOTA

STATE? NEW MEXICO
CAPITAL? SANTA FE
```

MECC-719 Elementary Volume 5, Language Arts
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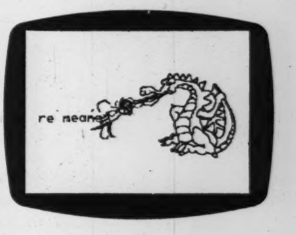

MECC-725 Elementary Volume 6, Social Studies
Historical simulations, "Oregon Trail", "Voyageur", and "Fur Trader" are included on this diskette. "Nomad" teaches students map reading, and "Sumer" is a simulation in which students govern a kingdom and decide how much food and land to give to the people without starving any of them. $24.95.

CAI Programs Volume II
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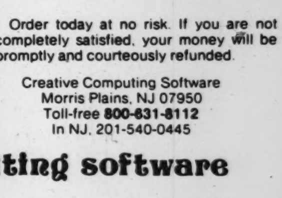

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Star Map, continued...

undefined size and their development is "played by ear." The control structure and the less important program functions are then built to suit the crucial parts of the program. Whereas top-down design breaks down large functions into smaller ones, bottom-up design handles these as large groups. These large groups are often difficult to handle and errors are more frequent in their development than in smaller groups used in the top-down method.

Although the coding of the computer program statements begins earlier in the bottom-up programming, it may require drastic changes later if the control structure is not compatible with the rest of the program. This can also happen with top-down design, but it is less likely because more care is taken in the design of the control program.

Modular programming involves small groups, each containing a particular function, called modules, which are often subroutines. Each module receives the information necessary for its function. It performs its function, and then transfers the new information back to the control program. The control program calls each module in its proper sequence. Modules can be changed readily without disturbing the other modules or the other control structure. Modular programs can be developed either in top-down or bottom-up fashion.

The star map program was developed using top-down modular design. I wrote the control program first and tested it by adding test stubs (print statements) at the beginning of the allotted space for each module. From these tests I could see that the control program called the modules in the proper sequence and correctly responded to the user input. This resulted in smooth operation of the program once the modules were written in their allotted space. Another advantage of such a design is that features which are to be added to an existing design of the program (see section 7.0) can be added as modules without upsetting the operation of the other modules. The HIPO (*H*ierarchy plus *I*nput *P*rocess *O*utput) diagram can be used instead of high-level flow charts for documentation of a software design. The HIPO diagram shown in Figure 6 portrays the control structure and modules used in this program.

This version of the Star Map program is written in TRS-80 Level II Basic, whereas the original version described here is written in PDP-11 DEC Basic-Plus.

The TRS-80 version includes two new features: first, the user can display a star map for any latitude between the equator and the North Pole. Second, the user can display every star above fifth magnitude for a selected list of visible constellations. (This feature is called "Constellation Enlargement.") □

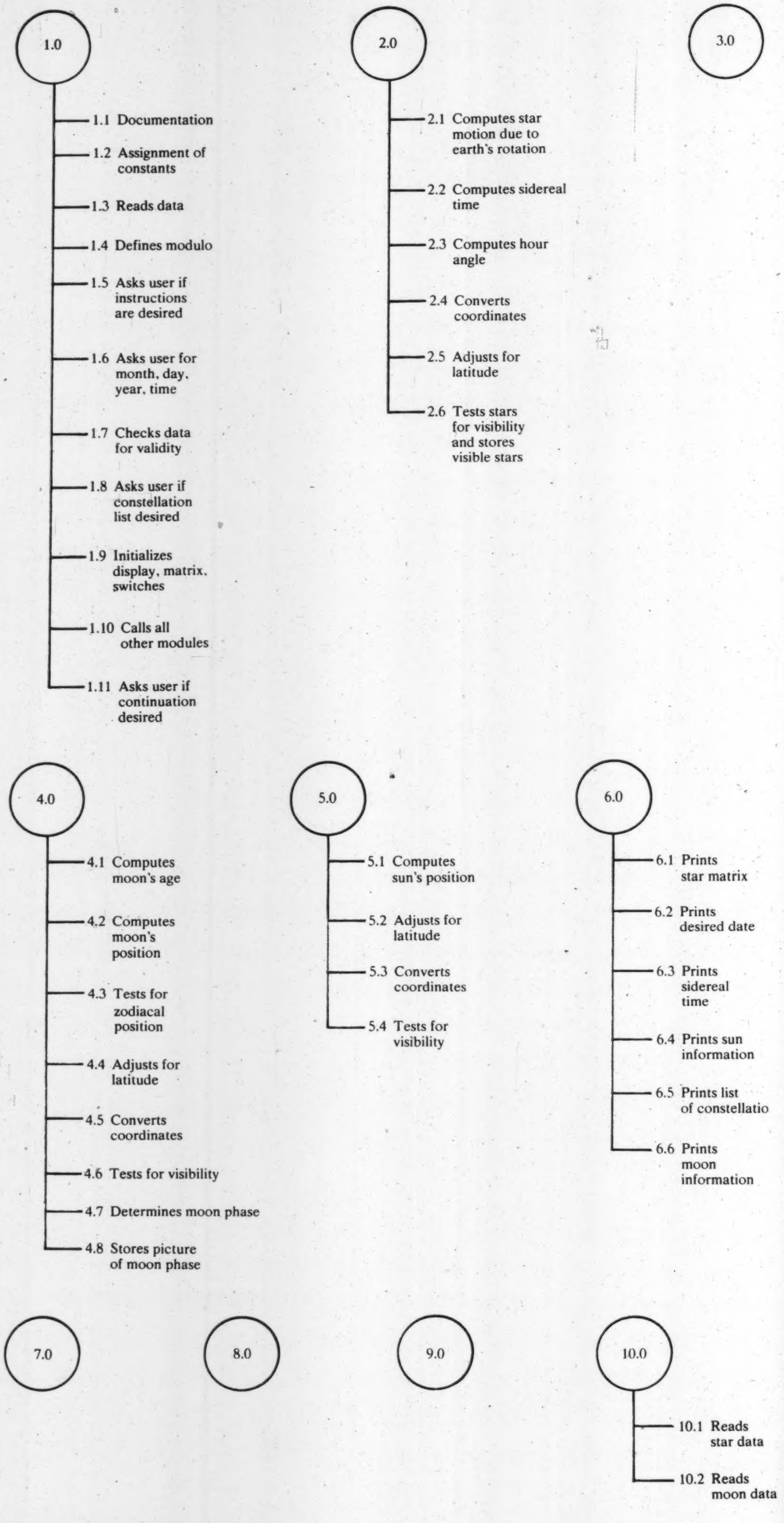
1.0
1.1 Documentation
1.2 Assignment of constants
1.3 Reads data
1.4 Defines modulo
1.5 Asks user if instructions are desired
1.6 Asks user for month, day, year, time
1.7 Checks data for validity
1.8 Asks user if constellation list desired
1.9 Initializes display, matrix, switches
1.10 Calls all other modules
1.11 Asks user if continuation desired
2.0
2.1 Computes star motion due to earth's rotation
2.2 Computes sidereal time
2.3 Computes hour angle
2.4 Converts coordinates
2.5 Adjusts for latitude
2.6 Tests stars for visibility and stores visible stars
3.0
4.0
4.1 Computes moon's age
4.2 Computes moon's position
4.3 Tests for zodiacal position
4.4 Adjusts for latitude
4.5 Converts coordinates
4.6 Tests for visibility
4.7 Determines moon phase
4.8 Stores picture of moon phase
5.0
5.1 Computes sun's position
5.2 Adjusts for latitude
5.3 Converts coordinates
5.4 Tests for visibility
6.0
6.1 Prints star matrix
6.2 Prints desired date
6.3 Prints sidereal time
6.4 Prints sun information
6.5 Prints list of constellatio
6.6 Prints moon information
7.0
8.0
9.0
10.0
10.1 Reads star data
10.2 Reads moon data

Figure 6. Continued.

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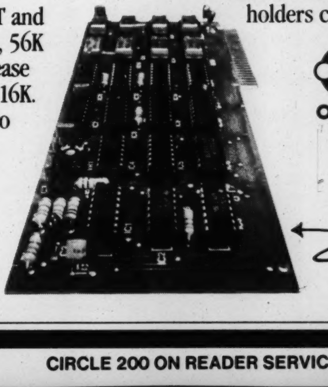

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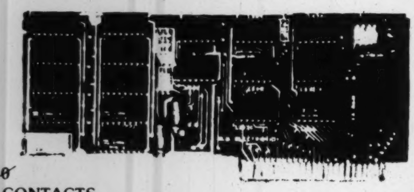

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Star Map, continued...

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10010 CLS:CLEAR150:DEFINTE,H-J,P,V:PRINTTAB(15);"STAR MAP PROGRA
M BY ANDREW SHOOMAN":FORI=15439TO15472:POKEI,131:NEXTI:PRINT:C=.
0174533:R2=6:E1=19:L0=29.5306:F=.98630137:GOSUB10530
10020 INPUT"DO YOU WANT INSTRUCTIONS";A$:IFLEFT$(A$,1)="Y"THEN10
380ELSEIFLEFT$(A$,1)="N"THEN10030ELSEPRINT"TYPE YES OR NO.":GOTO
10020
10030 INPUT"INPUT MONTH NUMBER, DAY, AND YEAR";M,D,Y1:IFM<1ORM>1
2ORD<1ORD>31THENPRINT"INVALID DATA.":GOTO10030
10040 INPUT"INPUT TIME IN HOURS AND MINUTES";H1,M1:IFH1<0ORH1>23
ORM1<0ORM1>59THENPRINT"INVALID DATA.":GOTO10040ELSED$=STR$(M)+"
/"+STR$(D)+" /"+STR$(Y1)+" AT"+STR$(H1)+" :"+STR$(M1)
10050 INPUT"INPUT LATITUDE IN DEGREES";L:IFL<0ORL>90THENPRINT"NO
RTHERN LATITUDES ONLY (BETWEEN 0 AND 90 DEGREES).":GOTO10050ELSE
GOSUB10330:GOSUB10120:GOSUB10100:GOSUB10140:GOSUB10250

10060 A$=INKEY$:IFA$=""THEN10060'***USER COMMAND***
10070 CLS:PRINTTAB(28);"COMMANDS":FORI=15452TO15459:POKEI,131:NE
XTI:PRINT
10080 PRINT@143,"1 DISPLAY STAR MAP":PRINT@207,"2 DISPLAY LIST O
F CONSTELLATIONS":PRINT@271,"3 DISPLAY MOON INFORMATION":PRINT@3
35,"4 DISPLAY CONSTELLATION ENLARGEMENT":PRINT@399,"5 CHANGE DAT
E, TIME, AND LATITUDE":PRINT@463,"6 END PROGRAM"
10090 E=0:PRINT@576,"INPUT COMMAND NUMBER";:INPUTE:IFE<1ORE>6THE
N10090ELSEONEGOTO10250,10280,10300,10420,10340,10960
10100 T1=(H1+M1/60)*15:MN=(D2(M)+D+99)*F+T1:MM=360:GOSUB10370:S=
MA:FORI=1TO40:MN=S-R1(I)+270:MM=360:GOSUB10370:T=MA:R=(90-D1(I))
*R2/90:GOSUB10350:Y=Y+(90-L)/90*R2'***STAR POSITION***
10110 IF(X-R2-1)[2+(Y-R2-1)[2>R2[2THENNEXTI:RETURNELSEM$(X,Y)=ST
R$(I):FORJ=1TOE1:IFI=E(J)THENV(J)=E(J):NEXTJ,I:RETURNELSENEXTJ,I
:RETURN
10120 R=R2:FORT=0TO359STEP22.5:GOSUB10350:IFT=0THENM$(X,Y)="W"EL
SEIFT=90THENM$(X,Y)="N"ELSEIFT=180THENM$(X,Y)="E"ELSEIFT=270THEN
M$(X,Y)="S"ELSEIFT<>0ANDT<>90ANDT<>180ANDT<>270THENM$(X,Y)="*"'*
**CIRCLE***
10130 IFL=90THENM$(X,Y)="S":NEXTT:RETURNELSENEXTT:RETURN
10140 MN=Y1:MM=19:GOSUB10370:MN=MA*10.875+28.9+D2(M)+D+T1/360:MM
=L0:GOSUB10370:A=MA:GOSUB10240:MN=A*12.1907+S1:MM=360:GOSUB10370
:R3=MA:MN=S-R3+270:MM=360:GOSUB10370:T=MA:D3=SIN(R3*C)*23.5:R=(9
0-D3)*R2/90:GOSUB10350:Y=Y+(90-L)/90*R2'***MOON INFO.***
10150 IF(X-R2-1)[2+(Y-R2-1)[2>R2[2THEN10160ELSEM$(X,Y)="M":V=1
10160 E=INT(R3):IFE>349ANDE<360THENW$="IN PISCES"
10170 FORI=1TO12:IFE>Z1(I)ANDE<Z2(I)THENW$="IN "+C$(Z(I))
10180 IFE>Z2(I)-1ANDE<Z3(I)THENW$="BETWEEN "+C$(Z(I))+" AND "+C$
(Z(I+1))
10190 NEXTI:A=INT(A):IFA=0THENW$="TOO CLOSE TO THE SUN TO SEE":V
=0
10200 IFA>=29ORA<=1THENP=8
10210 FORI=1TO7:IFA>=P1(I)ANDA<=P2(I)THENP=I
10220 NEXTI:FORI=1TO5:IFI=1ORI=5THENX$(I)=S$(P3(P))
10230 IFI=2ORI=3ORI=4THENX$(I)=S$(P4(P)):NEXTI:RETURNELSENEXTI:R
ETURN
10240 MN=(D2(M)+D+T1/360)*F+281.1:MM=360:GOSUB10370:S1=MA:MN=S-S
1+270:MM=360:GOSUB10370:T=MA:R=(90-SIN(S1*C)*23.5)*R2/90:GOSUB10
350:Y=Y+(90-L)/90*R2:IF(X-R2-1)[2+(Y-R2-1)[2>R2[2THENRETURNELSEM
$(X,Y)="O":S2=1:RETURN'***SUN'S POSITION***
10250 CLS:FORI=2*R2+1TO1STEP-1:FORJ=1TO2*R2+1:IFM$(J,I)=" "THEN1
0260ELSEPRINTTAB(4*(J+1));M$(J,I);'***STAR MAP DISPLAY***
10260 NEXTJ:PRINT:NEXTI:PRINTTAB(15);"STAR MAP FOR";D$:PRINTTAB(
15);"FOR";L;"DEGREES NORTH LATITUDE.":D0=S:GOSUB10360:PRINTTAB(1
5);"SIDEREAL TIME=";H0;":";M0;:IFS2=1THENPRINT@910,"(THE SUN IS
SHOWN AS 'O'--NO STARS VISIBLE).";
10270 PRINT@0,"PRESS ANY KEY";:PRINT@64,"TO CONTINUE.";:GOTO1006
0
10280 CLS:PRINTTAB(21);"LIST OF CONSTELLATIONS":FORI=15445TO1546
6:POKEI,131:NEXTI:PRINT:FORI=1TO13:PRINTI;C$(I);TAB(21);I+13;C$(
I+13);TAB(42);I+26;C$(I+26):NEXTI:PRINTTAB(42);40;C$(40);'***LIS
T OF CONSTELLATIONS***
10290 PRINT@960,"(PRESS ANY KEY TO CONTINUE).";:GOTO 10060
10300 CLS:PRINTTAB(22);"MOON INFORMATION":FORI=1TO5:PRINTTAB(28)
;X$(I):NEXTI:PRINTTAB(6);"(PATTERN OF X'S REPRESENTS PICTURE OF
MOON'S PHASE).":IFV=1THENPRINTTAB(11);"(THE MOON IS SHOWN ON THE
 STAR MAP AS 'M')."'***MOON DISPLAY***
10310 PRINT:PRINTTAB(21);"MOON'S AGE=";A;"DAYS.":PRINTTAB(21);"M
OON'S PHASE= ";P$(P):D0=R3:GOSUB10360:PRINT:PRINTTAB(10);"MOON'S
 POSITION:";:PRINTTAB(28);"RIGHT ASCENSION=";H0;":";M0:PRINTTAB(
28);"DECLINATION= ";USING"+##.#";D3;:PRINT" DEGREES"
10320 PRINTTAB(28);"THE MOON IS ";W$;:PRINT@979,"PRESS ANY KEY T
O CONTINUE.";:GOTO10060
10330 V=0:S2=0:CLS:PRINTCHR$(23);:FORI=1TO3:PRINT@466,STRING$(10
,32);:FORJ=1TO200:NEXTJ:PRINT@466,"-THINKING-":FORJ=1TO500:NEXTJ
,I:RETURN'***THINKING DISPLAY***
10340 FORI=1TO2*R2+1:FORJ=1TO2*R2+1:M$(I,J)=" ":NEXTJ,I:FORI=1TO
E1:V(I)=0:NEXTI:GOTO10030'***MATRIX INITIALIZATION***
10350 X=INT(R*COS(T*C)+.5)+R2+1:Y=INT(R*SIN(T*C)+.5)+R2+1:RETURN
'***COORDINATE CONVERSION***
10360 MN=INT(D0/15):MM=24:GOSUB10370:H0=MA:M0=INT((D0/15-INT(D0/
15))*60):RETURN'***RIGHT ASCENSION CONVERSION***
```

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Star Map, continued...

```
10370 MA=(MN/MM-INT(MN/MM))*MM:RETURN'***MODULO FUNCTION***
10380 '***INSTRUCTIONS***
10390 PRINT:PRINTTAB(5);"THE STAR MAP PROGRAM PRINTS A MAP OF TH
E SKY
ALONG WITH THE PHASE AND POSITION OF THE MOON AND CONSTELLATION
ENLARGEMENTS, FOR ANYWHERE IN THE NORTHERN HEMISPHERE, ON ANY
GIVEN DATE, AT ANY GIVEN TIME.  THE DATE AND TIME MUST BE"
10400 PRINT"INPUTTED IN THIS FORMAT:  THE DATE AS MONTH NUMBER,
DAY,
YEAR, (FOR EXAMPLE, MARCH 16, 1979 WOULD BE INPUTTED AS
'3,16,1979'), AND THE TIME IN HOURS AND MINUTES ON THE
24-HOUR CLOCK, (FOR EXAMPLE, 3:30 A.M. WOULD BE INPUTTED"
10410 PRINT"AS '3,30' BUT 9:30 P.M. WOULD BE '21,30').":PRINT:GO
TO10030


10420 CLS:PRINT"CONSTELLATION ENLARGEMENTS ARE AVAILABLE FOR:":E
=1:FORI=1TOE1:MN=E:MM=10:GOSUB10370:IFMA=0THENMA=10'***CONSTELLA
TION ENLARGEMENT***
10430 IFV(I)<>0THENPRINT@MA*64+INT((E-1)/10)*21,V(I);C$(V(I));:E
=E+1:NEXTIELSENEXTI
10440 PRINT@768,"";:E=0:INPUT"WHICH CONSTELLATION (ENTER NUMBER)
 DO YOU WANT TO ENLARGE";E:FORI=1TOE1:IFE=V(I)THENE=I:GOTO10450E
LSENEXTI:PRINT"CONSTELLATION #";E;"IS NOT ON THE LIST.":GOTO1044
0
10450 GOSUB10330:RESTORE:FORI=1TOP0(E):READA$:NEXTI:FORI=1TOS0(E
):READR4(I),D4(I),M4(I):NEXTI:X0=360:Y0=360:X9=0:Y9=0:FORI=1TOS0
(E):MN=S-R4(I)+270:MM=360:GOSUB10370:T=MA:R=(90-D4(I))*R2/90:X3(
I)=R*COS(T*C)+R2+1:Y3(I)=R*SIN(T*C)+R2+1
10460 IFX3(I)<X0THENX0=X3(I)
10470 IFY3(I)<Y0THENY0=Y3(I)
10480 IFX3(I)>X9THENX9=X3(I)
10490 IFY3(I)>Y9THENY9=Y3(I)
10500 NEXTI:CLS:FORI=1TOS0(E):X5=INT((X3(I)-X0)*44/(X9-X0)):Y5=I
NT((Y3(I)-Y0)*13/(Y9-Y0)):POKE15424+64*(13-Y5)+X5,B(M4(I)):NEXTI
::PRINT@982-LEN(C$(E(E)))/2-LEN(D$)/2,C$(E(E));"--";D$;:FORI=154
06TO16366STEP64:POKEI,191:NEXTI
10510 PRINT@309,"KEY TO";:PRINT@371,"MAGNITUDES";:FORI=15795TO15
804:POKEI,131:NEXTI:PRINT@501,CHR$(143);" = 0";:PRINT@565,"* = 1
";:PRINT@629,"O = 2";:PRINT@693,"+ = 3";:PRINT@757,". = 4";
10520 PRINT@0,"DO YOU WANT ANOTHER CONSTELLATION ENLARGEMENT";:I
NPUTA$:CLS:IFLEFT$(A$,1)="Y"THEN10420ELSEIFLEFT$(A$,1)="N"THEN10
070ELSEPRINT@64,"TYPE YES OR NO.":GOTO10520
10530 DIMM$(13,13),D2(12),C$(40),R1(40),D1(40),Z(13),Z1(12),Z2(1
2),Z3(12),S$(11),E(E1),P0(E1),S0(E1),V(E1),R4(33),D4(33),M4(33),
X3(33),Y3(33)'***DATA***
10540 FORI=1TO12:READD2(I):NEXTI:FORI=1TO40:READC$(I),R1(I),D1(I
):NEXTI:FORI=1TO12:READZ(I),Z1(I),Z2(I),Z3(I):NEXTI:Z(13)=40'***
STAR DATA***
10550 DATA0,31,59,90,120,151,181,212,243,273,304,334
10560 DATAPERSEUS,54.9,44.9,ERIDANUS,68.5,-30.7,TAURUS,75,22.6,A
URIGA,81.7,39,LEPUS,82.4,-19.3,ORION,83.8,-1.2,CANIS MAJOR,102.8
,-22.8,GEMINI,105,23.7,CANIS MINOR,113.1,6.8,PUPPIS,114.9,-38.5,
CANCER,130.5,18.3,LEO,160,16.3,URSA MAJOR,165.1,56.5
10570 DATAHYDRA,176.5,-17.7,CORVUS,186,-20.4,CENTAURUS,199.4,-48
,VIRGO,201,-1.3,LIBRA,219.9,-17.2,BOOTES,221,27.2,URSA MINOR,230
.2,81.3,CORONA BOREALIS,235.1,27.6,SCORPIUS,249.6,-30.3,HERCULES
,253,29.2,DRACO,257.2,65.7,OPHIUCHUS/SERPENS,257.3,-2.9
10580 DATASAGITTARIUS,278.4,-30.7,LYRA,281.8,35.7,AQUILA,291.1,3
.1,CYGNUS,305.4,40.2,DELPHINUS,308.8,14.4,CAPRICORNUS,314.9,-19.
1,AQUARIUS,332.4,-7.3,GRUS,334.3,-42.3,CEPHEUS,337.1,70,PISCIS A
USTRINUS,344.1,-29.7,ANDROMEDA/PEGASUS,1.8,29,CASSIOPEIA,13.9,60
.6

10590 DATAPISCES,16.4,8.8,CETUS,27.3,-10.6,ARIES,31.5,23.4
10600 DATA40,31,48,64,3,63,85,90,8,89,114,123,11,122,133,135,12,
134,171,173,17,172,220,224,18,223,240,242,22,241,269,271,26,270,
289,303,31,302,319,321,32,320,346,350,38,-1,28,32
10610 FORI=1TO11:READS$(I):NEXTI:FORI=1TO7:READP1(I),P2(I):NEXTI
:FORI=1TO8:READP$(I),P3(I),P4(I):NEXTI'***MOON DATA***
10620 DATA"  X X X","X X X X X","    X X","      X X","    X   X
","X X X X","X       X"," X X X X"," X X","X X","X   X"
10630 DATA2,5,6,9,10,13,14,16,17,20,21,24,25,28
10640 DATAWAXING CRESCENT,3,4,FIRST QUARTER,3,5,WAXING GIBBOUS,6
,7,FULL MOON,1,7,WANING GIBBOUS,8,7,LAST QUARTER,9,11,WANING CRE
SCENT,9,10,NEW MOON,1,2
10650 FORI=0TO4:READB(I):NEXTI:FORI=1TOE1:READE(I),P0(I),S0(I):N
EXTI:RETURN'***CONSTELLATION DATA***
10660 DATA143,42,79,43,46


10670 DATA1,291,23,3,360,28,4,444,10,6,474,25,7,549,19,8,606,19,
12,663,18,13,717,22,17,783,15,19,828,14,20,870,8,22,894,24,26,96
6,19,27,1023,10,28,1053,12,29,1089,22,34,1155,12,36,1191,33,37,1
290,10
10680 DATA25.6,50.6,4,40.7,49.1,4,42.3,55.8,4,42.3,38.2,4,43.2,5
2.7,4,45.8,53.4,3,46,38.8,3,46.7,40.9,2,46.9,49.5,4,47,44.8,4,50
.7,49.8,2,52.3,47.9,4,53.8,48.1,4,55.4,47.7,3,55.8,32.2,4,56,42.
5,4,58.2,31.8,3,59.1,40,3,59.4,35.7,4,61.3,50.3,4,61.8,47.7,4
```

TRS-80

Apple II

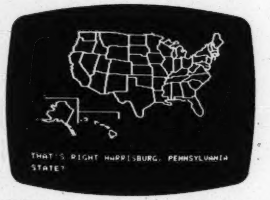
sensational software

creative computing software

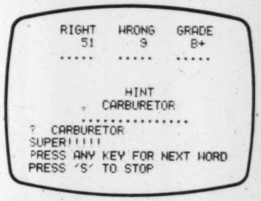
CAI Programs Vol I

Cassette CS-4201 $11.95

Requires 16K Apple II or Apple II Plus



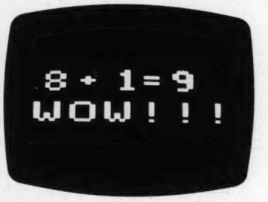
U.S. Map. Identify states and their capitals.



```
    RIGHT    WRONG    GRADE
      51       9        B+
    .....    .....    .....

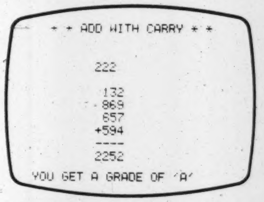

                HINT
             CARBURETOR
           ..............
?  CARBURETOR
SUPER!!!!!
PRESS ANY KEY FOR NEXT WORD
PRESS 'S' TO STOP
```

Spelling. Study aid with your list of troublesome words.



```
8 + 1 = 9
WOW!!!
```

Math Drill. Arithmetic drill and practice with large or small display.



```
     * * ADD WITH CARRY * *


           222

            132
            869
            657
           +594
           ----
           2252
   YOU GET A GRADE OF 'A'
```

Add With Carry. Drill and practice on sums requiring numbers to be carried.

Ecology Simulations - I

Disk CS-4706 $24.95	Requires 48K Applesoft in ROM or Apple II Plus
Cassette CS-3201 $24.95	Requires 16K TRS-80
Disk CS-3501 $24.95	Requires 32K TRS-80

Sterl

STERL allows you to investigate the effectiveness of two different methods of pest control—the use of pesticides and the release of sterile males into a screw-worm fly population. The concept of a more environmentally sound approach versus traditional chemical methods is introduced. In addition, STERL demonstrates the effectiveness of an integrated approach over either alternative by itself.

Pop

The POP series of models examines three different methods of population projection, including exponential, S-shaped or logistical, and logistical with low density effects. At the same time the programs introduce the concept of successive refinement of a model, since each POP model adds more details than the previous one.

Tag

TAG simulates the tagging and recovery method that is used by scientists to estimate animal populations. You attempt to estimate the bass population in a warm-water, bass-bluegill farm pond. Tagged fish are released in the pond and samples are recovered at timed intervals. By presenting a detailed simulation of real sampling by "tagging and recovery," TAG helps you to understand this process.

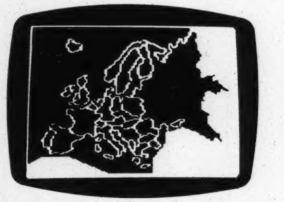
Buffalo

BUFFALO simulates the yearly cycle of buffalo population growth and decline, and allows you to investigate the effects of different heard management policies. Simulations such as BUFFALO allow you to explore "what if" questions and experiment with approaches that might be disatrous in real life.

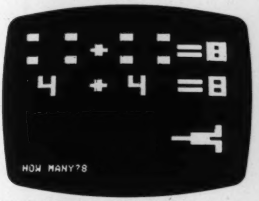
CAI Programs Vol II

Cassette CS-4202 $11.95

Requires 16K Apple II or Apple II Plus



European Map. Identify countries and their capitals.



```
▬ ▬ + ▬ ▬ =8
4  +  4   =8

HOW MANY?8
```

Meteor Math. Learn math skills by destroying menacing meteors.

Music Composing Aid. Make and play your own music on the Apple. No additional hardware required. Includes a sample from Bach's Tocatta & Fugue in D minor.

Ecology Simulations - II

Disk CS-4707 $24.95	Requires 48K Applesoft in ROM or Apple II Plus
Cassette CS-3202 $24.95	Requires 16K TRS—80
Disk CS-3502 $24.95	Requires 32K TRS-80

Pollute

POLLUTE focuses on one part of the water pollution problem; the accumulation of certain waste materials in waterways and their effect on dissolved oxygen levels in the water. You can use the computer to investigate the effects of different variables such as the body of water, temperature, and the rate of dumping waste material. Various types of primary and secondary waste treatment, as well as the impact of scientific and economic decisions can be examined.

Rats

In RATS, you play the role of a Health Department official devising an effective, pratical plan to control rats. The plan may combine the use of sanitation and slow kill and quick kill poisons to eliminate a rat population. It is also possible to change the initial population size, growth rate, and whether the simulation will take place in an apartment building or an eintire city.

Malaria

With MALARIA, you are a Health Official trying to control a malaria epidemic while taking into account financial considerations in setting up a program. The budgeted use of field hospitals, drugs for the ill, three types of pesticides, and preventative medication, must be properly combined for an effective control program.

Diet

DIET is designed to explore the effect of four basic substances, protein, lipids, calories and carbohydrates, on your diet. You enter a list of the types and amounts of food eaten in a typical day, as well as your age, weight, sex, health and a physical activity factor. DIET is particularly valuable in indicating how a diet can be changed to raise or lower body weights and provide proper nutrition.

CAI Programs I and II

Disk CS-4701, $24.95
Requires 32K Integer Basic

This disk contains all 7 programs from cassettes CS-4201 and CS-4202.

Note: The ecology simulations programs are not available on cassette.

Stock & Options Analysis

Stock & Options
Disk CS-4801 $99.95
Requires 32K Applesoft or Apple II Plus
Disk CS-3801 $99.95
Requires 32K TRS-80

This is a comprehensive set of four programs for the investment strategy of hedging listed options against common stocks. A complete description is in the TRS-80 section.

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Star Map, continued...

```
10690 DATA63.4,48.4,4,68.8,41.2,4
10700 DATA50.9,9,4,51.5,9.7,4,52.4,12.9,4,54,.3,4,55.9,24.1,4,56
,24.4,4,56.2,24.3,4,56.3,23.9,4,56.6,24,3,57,24,4,59.9,12.4,4,60
.5,5.9 4,60.9,22,4,63.6,8.8,4,64.7,15.6,4,65.4,17.5,4,66,22.2,4,
66.1,17.9,4,66.3,22.8,4,66.9,15.9,4,66.9,19.1,4
10710 DATA66.9,15.8,4,68.7,16.5,1,69.3,12.5,4,70.3,22.9,4,81.3,2
8.6,2,84.1,21.1,3,88,27.6,4
10720 DATA73.9,33.1,3,75.1,43.8,3,75.3,41,4,76.3,41.2,3,78.8,46,
0,87.5,39.1,4,89.5,54.3,4,89.5,44.9,2,89.6,37.2,3,93.5,29.5,4
10730 DATA72.2,6.9,3,72.4,8.9,4,72.5,5.6,4,73.3,2.4,4,73.8,13.5,
4,79.2,-6.9,4,78.4,-8.2,0,80.7,-7.8,4,80.9,-2.4,3,81,6.3,2,82.4,
5.9,4,82.7,-.3,2,83.4,9.5,4,83.5,9.9,4,83.6,-5.9,3,83.8,-1.2,2,8
4,9.3,4,84.4,-2.6,4,84.5,4.1,4,84.9,-2,2
10740 DATA86.7,-9.7,2,88.5,7.4,0,90.3,9.6,4,91.6,14.8,4,92.7,14.
2,4
10750 DATA94.9,-30.1,3,95.5,-17.9,2,96.9,-32.6,4,97.8,-23.4,4,98
.6,-22.9,4,99,-19.2,4,101.1,-16.7,0,102.3,-32.5,4,103.3,-12,4,10
3.3,-24.2,4,103.8,-17,4,104.5,-28.9,2,105.2,-27.9,4,105.5,-23.8,
3,105.7,-15.6,4,106.9,-26.4,2,108.5,-26.7,4
10760 DATA109.5,-24.9,4,110.8,-29.3,2
10770 DATA90.7,23.3,4,93.4,22.5,3,95.4,22.5,3,96.9,20.2,4,99.1,1
6.4,2,100.7,25.2,3,101,12.9,3,102.9,34,4,105.7,20.6,4,107.5,30.3
,4,109.2,16.6,4,109.7,22,4,111.1,27.8,4,112,31.8,4,113.3,31.9,2,
113.7,26.9,4,115.5,28.9,4,115.8,24.4,4,116,28.1,1


10780 DATA142.6,23.1,4,145,10,4,146.2,23.9,3,147.9,26.1,4,151.6,
16.9,4,151.8,12.1,1,153.9,23.5,4,154.7,19.9,3,157.9,9.4,4,163.6,
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6.9,51.7,4,142.5,63.2,4,142.9,51.8,3,147.4,59.1,4,147.7,54.2,4,1
54,43,3,155.3,41.6,3,165.2,56.5,2,165.6,61.9,2,167.1,44.6,3,169.
3,31.6,4,169.4,33.2,4,176.2,47.9,4,178.2,53.8,2
10800 DATA183.6,57.1,3,193.3,56.1,2,200.8,55,2,206.7,49.4,2
10810 DATA176.2,6.6,4,177.4,1.9,4,181,8.8,4,184.7,-.6,4,190.2,-1
.3,3,193.6,3.5,4,195.3,11.1,3,197.2,-5.4,4,201,-11.1,1,203.4,-.5
,3,210.2,1.6,4,213,-10.2,4,213.7,-5.9,4,220.5,-5.6,4,221.3,2,4
10820 DATA206.6,17.6,4,207.1,15.9,4,208.4,18.5,3,213.7,19.3,0,21
3.9,46.2,4,216.1,51.9,4,217.7,30.5,4,217.8,38.4,3,218.5,29.8,4,2
20,13.8,4,221,27.2,3,225.3,40.5,4,228.7,33.4,3,230.9,37.4,4
10830 DATA32.9,89.2,2,216.9,75.8,4,222.7,74.2,2,230.2,71.9,3,236
.2,77.9,4,244.1,76.1,4,252,82.1,4,264.7,86.6,4
10840 DATA238.9,-29.2,4,239.4,-26.1,3,239.8,-22.6,2,240.8,-11.3,
4,241.1,-19.8,3,241.4,-20.6,4,242.7,-19.4,4,245,-25.5,3,247,-26.
4,1,247.5,-34.7,4,248.7,-28.2,3,248.8,-35.2,4,252.2,-34.3,2,252.
6,-38,3,252.7,-38,4,253.3,-42.3,4
10850 DATA257.7,-43.2,3,262.4,-37.3,3,263.1,-37.1,2,263.8,-38.6,
4,264,-43,2,265.3,-39,2,266.5,-40.1,3,267.1,-37,3
10860 DATA271.1,-30.4,3,273.1,-21.1,4,274.1,-36.8,3,274.9,-29.8,
3,275.7,-34.4,2,276.7,-25.4,3,281.1,-27,3,283.5,-26.3,2,284.1,-2
1.1,4,285.3,-29.9,3,285.9,-21.8,4,286.4,-27.7,3,287.1,-21.1,3,29
0.1,-17.9,4,290.3,-44.5,4,290.4,-44.8,4,290.6,-40.7,4,298.5,-41.
9,4
10870 DATA299.6,-35.3,4
10880 DATA274.8,36.1,4,279.1,38.8,0,280.9,39.6,4,281,37.6,4,282.
3,33.3,4,283.5,36.9,4,283.7,43.9,4,284.5,32.7,3,288.3,39.1,4,288
.9,38.1,4
10890 DATA284.7,15,4,285.2,-5.8,4,286.1,13.8,3,286.3,-4.9,3,291.
1,3.1,3,293.9,-1.3,4,296.3,10.6,3,297.5,8.8,1,297.9,1,4,298.6,6.
4,4,302.6,-.9,3,309.3,-1.2,4
10900 DATA289.2,53.3,4,292.3,51.7,4,292.5,27.9,3,296.1,45.1,3,29
8.9,35,4,303.2,56.5,4,303.3,46.7,4,303.7,47.7,4,305.4,40.2,2,307
.1,30.3,4,310.2,45.2,1,311.2,30.6,4,311.4,33.9,3,311.7,36.4,4,31
4.1,41.1,4,316.1,43.8,4,318,30.1,3,318.5,38,4,319.2,39.3,4
10910 DATA319.3,34.8,4,323.3,45.5,4,326.5,49.2,4
10920 DATA 302.4,77.7,4,307.3,62.9,4,311.2,61.8,4,319.5,62.5,3,3
22.1,70.5,3,326.2,61,4,332.5,58.1,4,333.6,56.9,4,337.1,58.3,4,34
2.2,66.1,4,354.6,77.5,3,16.4,86.2,4


10930 DATA320.3,19.7,4,325.8,9.8,2,325.9,17.3,4,325.9,25.6,4,331
.5,25.2,4,332.3,33.1,4,332.3,6.1,4,340.1,10.7,4,340.5,30.1,3,341
.4,23.5,4,341.4,12.1,4,342.3,24.5,4,345.2,42.2,4,345.7,28,3,345.
9,15.1,3,354.1,46.3,4,354.3,43.2,4,354.9,44.2,4
10940 DATA1.8,29,2,3.1,15.1,3,4,38.6,4,4.3,36.7,4,9,33.6,4,9.4,2
9.2,4,9.6,30.8,3,11.6,24.2,4,12.2,41,4,13.9,38.4,4,17.1,47.1,4,1
7.2,35.5,2,23.9,41.3,4,24.2,48.5,4,30.7,42.2,2
10950 DATA2,59,2,8,62.8,4,9,53.8,4,9.8,56.4,2,12,57.7,4,13.9,60.
6,2,17.5,55,4,21.1,60.1,3,28.2,63.6,3,30.4,72.3,4
10960 END
READY
```

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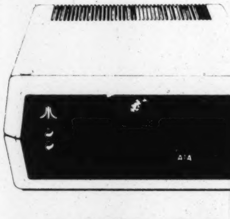

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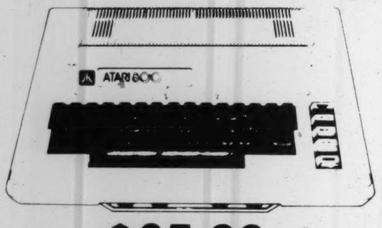

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Sample Run.

```
               STAR MAP PROGRAM BY ANDREW SHOOMAN
               ..................................
DO YOU WANT INSTRUCTIONS? Y

     THE STAR MAP PROGRAM PRINTS A MAP OF THE SKY
ALONG WITH THE PHASE AND POSITION OF THE MOON AND CONSTELLATION
ENLARGEMENTS, FOR ANYWHERE IN THE NORTHERN HEMISPHERE, ON ANY
GIVEN DATE, AT ANY GIVEN TIME.  THE DATE AND TIME MUST BE
INPUTTED IN THIS FORMAT:  THE DATE AS MONTH NUMBER, DAY,
YEAR, (FOR EXAMPLE, MARCH 16, 1979 WOULD BE INPUTTED AS
'3,16,1979'), AND THE TIME IN HOURS AND MINUTES ON THE
24-HOUR CLOCK, (FOR EXAMPLE, 3:30 A.M. WOULD BE INPUTTED
AS '3,30' BUT 9:30 P.M. WOULD BE '21,30').

INPUT MONTH NUMBER, DAY, AND YEAR? 8,20,1980
INPUT TIME IN HOURS AND MINUTES? 21,0_
INPUT LATITUDE IN DEGREES? 40



PRESS ANY KEY           *       N       *

TO CONTINUE.             1

                *                        13     *

                         37      20

        *        36          34      24                 *

                                                 19

        E                    29              21         W

             32          30      27      23

        *                                               *

                 31          28              25

                *                   M            22

                                 26

                        *       S       *

               STAR MAP FOR 8 / 20 / 1980 AT 21 : 0

               FOR 40 DEGREES NORTH LATITUDE.

               SIDEREAL TIME= 18 : 45
```

"By Golly, Sims, when it gets to vibrating like that I do believe it's laughing at us."

```
                             COMMANDS
                             ........
                1 DISPLAY STAR MAP
                2 DISPLAY LIST OF CONSTELLATIONS
                3 DISPLAY MOON INFORMATION
                4 DISPLAY CONSTELLATION ENLARGEMENT
                5 CHANGE DATE, TIME, AND LATITUDE
                6 END PROGRAM

 INPUT COMMAND NUMBER? _
                     LIST OF CONSTELLATIONS
                     ......................
  1 PERSEUS           14 HYDRA             27 LYRA
  2 ERIDANUS          15 CORVUS            28 AQUILA
  3 TAURUS            16 CENTAURUS         29 CYGNUS
  4 AURIGA            17 VIRGO             30 DELPHINUS
  5 LEPUS             18 LIBRA             31 CAPRICORNUS
  6 ORION             19 BOOTES            32 AQUARIUS
  7 CANIS MAJOR       20 URSA MINOR        33 GRUS
  8 GEMINI            21 CORONA BOREALIS   34 CEPHEUS
  9 CANIS MINOR       22 SCORPIUS          35 PISCIS AUSTRINUS
 10 PUPPIS            23 HERCULES          36 ANDROMEDA/PEGASUS
 11 CANCER            24 DRACO             37 CASSIOPEIA
 12 LEO               25 OPHIUCHUS/SERPENS 38 PISCES
 13 URSA MAJOR        26 SAGITTARIUS       39 CETUS
(PRESS ANY KEY TO CONTINUE).               40 ARIES

                      MOON INFORMATION
                                X X
                                X   X
                                X   X
                                X   X
                                X X
      (PATTERN OF X'S REPRESENTS PICTURE OF MOON'S PHASE).
           (THE MOON IS SHOWN ON THE STAR MAP AS 'M').

                     MOON'S AGE= 9 DAYS.
                     MOON'S PHASE= FIRST QUARTER

          MOON'S POSITION:  RIGHT ASCENSION= 18 : 9
                            DECLINATION= -23.5 DEGREES
                            THE MOON IS IN SAGITTARIUS
                   PRESS ANY KEY TO CONTINUE.
CONSTELLATION ENLARGEMENTS ARE AVAILABLE FOR:
  1 PERSEUS           36 ANDROMEDA/PEGASUS
 13 URSA MAJOR        37 CASSIOPEIA
 19 BOOTES
 20 URSA MINOR
 22 SCORPIUS
 26 SAGITTARIUS
 27 LYRA
 28 AQUILA
 29 CYGNUS
 34 CEPHEUS

WHICH CONSTELLATION (ENTER NUMBER) DO YOU WANT TO ENLARGE? _

DO YOU WANT ANOTHER CONSTELLATION ENLARGEMENT? _

              .                               .

                                              .

          + .                                 .

          .  +            + +                 .      KEY TO

+             .                               .    MAGNITUDES

          .                               . . .    ..........

     .                        +               .      ■ = 0

                  0                           .      * = 1

             0                .               .      0 = 2

                       0                      .      + = 3

                     +                        .      . = 4

                      0                       .

                       0                      .

                            0                 .

     URSA MAJOR-- 8 / 20 / 1980 AT 21 : 0     .
```

Stephen B. Gray

rings...trs-80 strings...trs-8

On the 38th turn of the TRS-80 wheel, we look into how this column is now being prepared on disk, how *Creative's* phototypesetting system operates, the advantages of disk, how to move up in the world of disk, a note on software etiquette, *The Alternate Source* magazine, the TASMON monitor/disassembler, the death of *80 Software Critique*, a short program for target-bombers, and a maxim of no relation to hiram percy.

Column on Disk

Last year I was asked to start submitting my book reviews and TRS-80 column on disk, because several hours of keyboarding time can be saved if the material can be input directly to the typesetting system, and errors are minimized.

There are very few typewriters at *Creative Computing*, because just about every keyboard in the company is part of a computer or a terminal, which saves much time in editorial, circulation, accounting and all the other departments.

With editorial material submitted on disk, all corrections and changes can be made on the disk system, without all the retyping so common to publishing in pre-computer days.

So, after some kinks were ironed out in the system that allows me to submit my column and reviews on a single Scripsit disk instead of about two dozen sheets of paper every month, I sent in this first disk.

(Although I thought I was the first contributing columnist to do so, it seems the Atari column was sent in on disk by George Blank when he was writing it.)

From Disk to Type

The Scripsit disk is run through a program written by George, which automatically inserts typesetting symbols that indicate indentations and the ends of paragraphs, removes extra spaces, etc., and which changes the Scripsit control characters to the Electric Pencil control characters used by the typesetter.

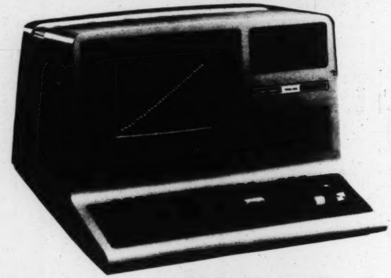

Figure 1. A 48K TRS-80 Model III with two drives permits maximum use of disk and of Disk Basic.

George's assistant Diane Feller makes a printout of the disk, which is then edited by Betsy Staples, *Creative's* editor.

Jean Vokoun or Maureen Welsh, in the typesetting department, makes the editorial corrections on the original text. Then Jean or Maureen loads the text file into an LNW80 computer (electronically identical to the TRS-80 Model I), and types a brief code that outputs the file to the AlphaComp phototypesetting machine.

The AlphaComp, using a spinning photographic disk that contains all the characters for one type size, in regular, italic and boldface fonts, projects the text file, one character at a time, onto photographic film, to create lines of print.

The film is developed, and the finished product, for this TRS-80 column, is a column of type 13.5 picas (2.25") wide.

Disk

The move from cassette up to disk is, for most of us, a radical and difficult change. Aside from the cost of a disk drive, which is much more than a cassette recorder, there is the shift from the familiar Philips audio cassette to the somewhat mysterious spinning disk.

Just how the computer manages to put information on this thin sheet of plastic, whirling at high speed, and then take it off again, borders on magic for those of us who still don't quite understand how a computer can put all those bits and bytes on a skinny little strip of tape.

But for those who can afford the step up, and who are interested in learning a whole bunch of new concepts and commands (although you can get along without most of them), the rewards can be considerable.

Disk Advantages

A 13,000-byte program that takes 3½ minutes to load from Model I (Level-II) cassette tape will load in less than eight seconds from Model III disk (Figure 1). And you don't have to spend time searching for the program, in comparison with often having to take many minutes searching a long tape for the program you want.

File-handling just isn't practical with tape, and although many programs are available for doing it, they are rather awkward to use. With disk, you have many commands that allow you to do a great variety of things with files.

More and more software companies are moving toward disk, especially for the complex game and business programs that just can't be written for tape-based systems without having to cut corners and leave out features, if, indeed, they can be written at all for tape systems.

The TRS-80, and most other personal computers, can read tapes made with almost any cassette recorder, from $25 cheapies to the most expensive Nakamichi or Vector Research machine. But you sometimes have loading problems; if you have bought tapes from a wide variety of sources, you have probably found at least one that requires much fiddling with the volume control to make it load, if it loads at all.

Disk drives are all fairly similar in design, and a disk very seldom fails to load. Also, you know fairly soon if one won't, whereas with tape you usually have to wait, sometimes many minutes, until the end of the attempted load, to get the error messages signalling a bad load.

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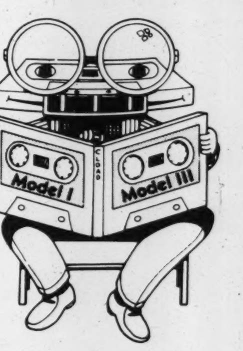

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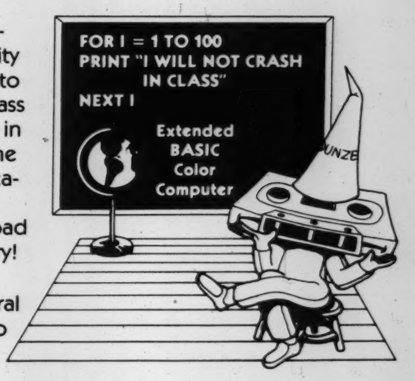

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TRS-80, continued...

Levels of Disk Sophistication

As with some other complex devices, you can use a TRS-80 Model III disk system at several different levels. At the lowest level, you can simply load games and/or application programs via tape or disk, without having to know much about tape or disk or Basic or computers. Many programs are user-oriented, meaning they assume little or no knowledge on your part, and guide you through every step of loading and running the program. Then, as you gain confidence and experience, you can get into the higher, more complicated, levels of computing.

At the next level up, you can get into Disk Basic without disk drives in your Model III. As the Radio Shack manual puts it, "Disk Basic adds many features which are not disk-related."

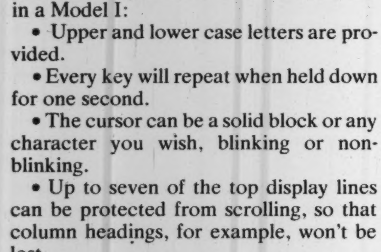
Starting Slow: III Without Disk

If you want to start slowly, at minimum cost, and sneak up on disk, you can get a 4K Level I Model III for $699 or a 16K Model III with Model III Basic for $999 (at this writing).

Without disk, but with Model III Basic, you have many features that aren't available in a Model I:

- Upper and lower case letters are provided.
- Every key will repeat when held down for one second.
- The cursor can be a solid block or any character you wish, blinking or nonblinking.
- Up to seven of the top display lines can be protected from scrolling, so that column headings, for example, won't be lost.
- 96 special characters are available, including vowels with accent marks (for foreign languages), full Greek alphabet, smiling face, frowning face, Copyright and Registered symbols, and math symbols for pi, infinity, not-equal, etc.
- If you are interested in the Japanese language, you can display the phonetic katakana characters.
- You can transfer cassette data at the 500-baud Level-II rate, or save time LOADing or SAVEing by doing it at 1,500 baud.
- A screen-print function prints whatever is on display, except special or graphics characters (displayed as periods).
- A real-time clock can be displayed at the top right of the screen.
- Hex or octal constants can be used instead of their decimal counterparts in your programs.
- REM lines or spaces can be automatically deleted from your programs.
- Arrays can be sorted.
- Program lines can be cross-referenced.
- A string can be searched to see if it contains another string.
- Program lines can be automatically renumbered.

Other special features are of interest mainly to those really into programming.



"We're looking for something in a moderate size breeder reactor."

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One Disk Drive

You can do a great deal with only one disk drive, but there are some problems. On the TRS-80, you can't use program disks that don't have the operating system written on them, unless you have something like LDOS ($139 from Lobo International, 354 South Fairview Ave., Goleta, CA 93117), which has a single-drive load program called XFER among its many fine features.

A great deal of business software requires two disks. Backing up disks (making copies so you can put the originals aside for safekeeping) is much slower if you have only one disk drive. With only one drive, George Blank says "you have to be innovative."

With Disk

Once you have a disk drive, you can move one level higher and use the disk-related features of Disk Basic, such as KILL (delete a program or data file from the disk), MERGE programs, OPEN and CLOSE files, DEBUG machine-language programs, and two dozen others.

At the top level, you can dig into TRSDOS, the disk operating system that takes care of all the housekeeping tasks involved with running the system efficiently. If you like complexity, you can delve into TRSDOS for many months, perhaps years, before you can say you understand it thoroughly, especially all the little details involving files.

Proper Courtesy

A Missouri P.E. writes that a program published in the Radio Shack *Microcomputer Newsletter* in early 1980 is, "with very minor changes...identical to one published" late last year in this column, sent in by another reader.

He adds, "While I realize that you cannot afford the time to check each program for originality, it might be a good thing to devote a portion of your column to the subject of proper courtesy. While not actually pointing the finger at a particular person, it might just bring the point home."

The cores of the two programs are identical, line for line, far beyond the possibility of simple coincidence.

If you borrow, how about giving credit?

The Alternate Source

Billed as "The magazine for advanced applications and software for the TRS-80," *The Alternate Source* ($18 for twelve monthly issues, 1806 Ada St., Lansing, MI 48910) is published by a company of the same name that also offers the bimonthly *Between The Issues* "tidbit" that is "an extension of *TAS*" ($7 for six issues), original software such as TRAKCESS, ISAR, VARKEEP, Schoolmaster, KBE (keyboard and screen editor) and *TASMON* (monitor/disassembler), plus several game programs, and games and utilities from other sources.

The latest issue I have of *TAS* is a 68-page booklet with 13 software articles, including a machine-language program for relocating Basic programs, a regular column of solutions to readers' problems, enhancements to NEWDOS/80, correlation analysis with VisiCalc, how to write your own disk routines, Shell-Metzner sort in machine language (using only 200 bytes), and a continuing series on basic statistics and the microcomputer.

TAS is obviously for the assemblernik and diskophile. Other articles in earlier issues look at, mainly from a software viewpoint, the Pocket Computer, Color Computer, and Model III, plus undocumented Z-80 opcodes, speeding up sequential search, and data packing, and provide dozens of machine-language programs.

Volume I, the first six issues of *TAS*, is available as a bound volume at $14.95.

High-Resolution Color in 4K

As an example of the *TAS* style, consider a paragraph from Dennis Kitsz's 11½-page article on the Color Computer in Vol. II, No. 1, titled "In Popular Decorator Colors," in which he reported several items of "misinformation" resulting from a call to a Radio Shack repair center. One item:

"Repair also reported that there was no way of accessing the high-resolution mode without the Extended Basic. How about machine language? Nope, ya gotta have the Extended Basic. Well, folks, try this:

```
10 POKE 65473,0
20 FOR X=1024 TO 1535
30 POKE X, RND(255)
40 NEXT
50 FOR X=2000 TO 4000
60 POKE X, RND(255)
70 NEXT
```

Watch that screen fill up with graphics dots in high resolution. Sure, you can make out that they are bits and pieces of characters, but this is just a crude access to show it can be done. (The spaces between 1535 and 2000 are left so as not to blow any Basic pointers.)"

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TRS-80, continued...

Has anybody figured out how to access the high-resoution mode fully without Extended Basic?

TASMON

The Alternate Source's *TASMON* monitor/disassembler, for "Level II, a disk system or a Model III with 32K recommended," is $29.95 for tape or disk.

Some of the many features of *TASMON* are: examine/modify memory and Z-80 registers, execute machine-language programs (in real time, single-step or slow motion), display any of three different memory dumps at screen left while executing any *TASMON* command at screen right, disassemble memory and route to disk or tape as an Editor/Assembler source file, find one to four consecutive bytes, relocate system programs, load or write a system tape or /CMD disk file, set or display or clear breakpoints, and trace at eight speeds.

Operation of *TASMON* is simple. Once you have entered it, you get a register display at top-right screen. You enter commands just below this display.

To get a hex dump, simply type H 5200 to start at address 5200, and 15 lines will display memory contents from 5200 to 5277. Press the space bar to get the next 15 lines, or Break to exit the command.

For an ASCII dump, use A F00C, for example, and for a disassembled dump, D 0000. On all these dumps, there is no need to press Enter, because *TASMON* counts the digits.

Among the leading features of *TASMON* is the ability to single-step the Basic interpreter written by Microsoft. You enter a Basic program from the keyboard and RUN it; *TASMON* steps through the ROM routines of the Basic interpreter to perform these tasks.

The *TASMON* manual goes beyond most manuals by providing seven "sample sessions" that show exactly how the utility is used, in relocating programs, single-stepping a machine-language file loaded from disk, using the TRACE command to step through the startup procedure for ROM and execute a Basic program, etc.

TASMON has 46 commands, from A for ASCII dump to Z SS EE h, for "set memory from SS to EE equal to h." If you're into machine language, you should check out this highly useful and ingenious file-oriented utility.

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"You see doctor, I was very unhappy as a prototype."

80 Software Critique Ends

With its fifth issue, the quarterly *80 Software Critique* suspended publication last year. The first issue was dated Oct/Dec 1979; the last was undated but published in late Jan. 1981.

The issues contained reviews of about 50 programs or collections of programs: 40 games and simulations, plus ten practical and educational.

The letter sent by publisher Richard W. Clope to subscribers said, in part, "The reason for stopping publication is simple. Only 30 percent of our original subscribers renewed their subscriptions. There are not enough of you remaining to publish even on a breakeven basis."

The letter also provided "recommendations to receive the best programs and fastest service," including:

- All new vendors that offer a variety of programs should be treated with caution. Buy only one program from his selection and check it out for quality before you spend more money.
- Buy from companies that have an 800 telephone (no-charge) number.
- Watch the fine print for shipping charges and restrictions on returning defective tapes and disks.
- Buy from companies that offer guarantees.
- Insist on good service. If it takes more than two weeks to get delivery on an order placed over the phone using a credit card, take your business elsewhere.

The letter gives an overall rating of *excellent* to programs from Adventure International, Automated Simulations, Lance Micklus, Acorn, Basics & Beyond, Synergistic Solar, and Big Five. *High-quality* ratings went to Personal Software, Dynacomp, Innovative Penguin, and Steketee Educational Software. *Uneven quality* was the word for programs from Hayden Book Co., Instant Software, and Krell Software. Clope noted that "these are only my opinions and reflect only on the quality of the product and not the quality of service."

The ratings were based on six categories: fun or utility (30 points), originality (20), bugs (20), instructions (10), technique (10) and dollar value (10).

The reviews described what each program does, mentioned its good and bad points, gave it a rating and a short summary. In issue #1, George Blank's *Clipper* got a 91 rating, and was described as "an excellent program and highly recommended." *Sargon* got an 87 rating, better than the 82 for *Microchess 1.5. Kentucky Derby* from TSE Hardside was "not recommended."

In issue 5, *Startrek 3.2* from Dynacomp got an 88 rating, and was called "a good Trek program." Six *Micro-Stories* from Interactive Fiction are "lots of fun," and rated 93. Acorn's *Structured Basic Translator* is "a good package, easy to use."

The reviews were often extensive, often taking several pages to cover a complex program. Although this was a publication for the person who buys a lot of software, nevertheless, as Clope said in his letter to me, "A real need exists for a publication like this, but maybe in a different format."

He continued, "I am satisfied with the job I did. I feel the reviews were thorough and fair, both to the vendor and the purchaser. I have a supply of about 100 copies of issues 3, 4 and 5 left, and a few of issue 2 remain."

Presumably they are $7 each, which was the original single-copy price. If you'd like to read the reviews, which are, indeed, thorough and fair, *80 Software Critique* is (or was) at P.O. Box 134, Waukegan, IL 60085.

Meanwhile, the banner has been taken up by *Software Critic* (Dec. 1981, p. 322), born in New Mexico five months after the demise of the Illinois publication.

Short Program #27: Bomb The Target

Paul A. Robinson of East Liverpool, OH, sent this:

"Here's a very short program for a simple game I thought up. The object is to 'drop' a bomb on a randomly selected target at the bottom of the screen.

"You 'fire' when directly over the target by hitting the F key. The program keeps track of how many times you fire, and prints it at the end."

Note that the target doesn't appear until the second bombing run.

If you're wondering what the I-loop in line 10 does, try deleting it and see what happens. You may need a little longer to figure out what the second CLS is for; the game works without it, but becomes a slightly different game.

Launegayer's Maxim

All the world's an analog stage, and digital circuits play only bit parts. ☐

```
5 CLS: '--- BOMB THE TARGET ---
10 FOR C=1 TO 120: SET(C,5): FOR I=1 TO 10: RESET(C,5)
20 A$=INKEY$: IF A$="F" THEN GOSUB 30 ELSE NEXT C: CLS
25 L=RND(120): SET(L,40): GOTO 10
30 P=P+1: FOR K=1 TO 40: SET(C,K)
40 IF POINT(L,39) THEN PRINT "YOU GOT IT!! AND IT ONLY
   TOOK YOU"; P;"TIMES" ELSE RESET(C,K): NEXT: GOTO 10
```

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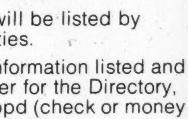
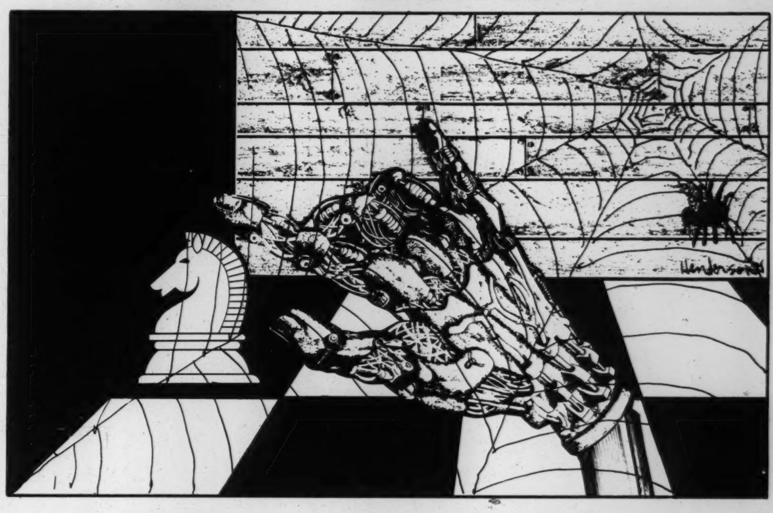


CIRCLE 229 ON READER SERVICE CARD

TRS-80

Has the computer made Chess obsolete?



Has the computer made Chess obsolete?

Chess offers an excellent example of the misuse of the power of the computer. Every month someone makes a claim that their computer chess program is the new champion. Right now, no computer program can beat the world champion, but it will happen some day. The problem is that the computer is being used to destroy a human pastime and turn it over to machines, not to enhance the pastime. Instead of getting a computer to play a better game of chess, we should use the computer to make chess a better game.

Chess is a clever imitation of war, but it has one serious tactical flaw. In war, you seldom fully know the movements of your enemy. The answer was to invent a form of chess in which you did not know where your enemy's pieces were until you made contact with each piece.

Eighty years ago, a set of rules was invented for "blind" chess, and the result was Kriegspiel. The game is popular in chess clubs, but, unfortunately, Kriegspiel requires a skilled referee. The referee has to know chess well, and must be extremely careful. One mistake by the referee and the game becomes total confusion. Yet the job of a Kriegspiel referee is very boring. He can only watch and interpret the game to each of the players, not play. The perfect solution is to let a computer be the referee.

When Kriegspiel was first automated, on a programmable calculator, the calculations took several minutes for each move. A variation was created that took only a few seconds per move, and was named Phantom Chess. The computer is much faster, and calculation time is no longer a problem, but many players thought Phantom Chess was more fun than even Kriegspiel. We are not going to take sides in the debate. Instead, we offer both games in one package. Play them both, and make up your own mind.

Why play an obsolete, easily mechanized game like chess, when you can play an infinitely more subtle game? In Kriegspiel and Phantom Chess, you must guess what your opponent is doing, prepare subtle traps, and still use all the skill and craft of chess.

These are two player games. Since Kriegspiel and Phantom Chess use the computer only as a referee, you must find a human opponent.

Kriegspiel and Phantom Chess

is available on cassette for a TRS-80* Model I or Model III with 16K of memory. Cassette CS-3016 $19.95

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Will Fastie

I'm not a person easily driven to ranting and raving and tearing my hair out. I try not to scream and yell. Although it is sometimes measured in milliseconds with my son of six, I count patience as one of my virtues. That is why there is no "Photo 1" this month.

Ah. You've guessed, I see. And you're right, of course—I don't have my own personal IBM Personal Computer yet. I'm quite sure I'll have it by the time you read this (haven't I heard that somewhere before?), but I think I might make (have made) a liar out of myself in the January column. It may be (have been?) the case that when you read it I didn't have my system. Sigh. Let's talk about something happier before I lose total control of my tenses.

This month I've put together a set of brief discussions of more or less separate topics. A program, promised last month, is here. I've found some books that might be of interest, and I'm inaugurating a section devoted to my mistakes. I have a quick note about operating systems. First, though, I have some news from IBM.

IBM Announcements

In time for Christmas, IBM announced a number of important software packages. The press release did not arrive before my deadline so I don't have as much detail as you deserve. The three most important announcements were for USCD Pascal, Fortran, and a Macro Assembler. The rest of the announcement involved an accounting package and some educational programs.

The IBM Fortran compiler and the IBM Macro Assembler are from Microsoft, and were scheduled to be available in March and February, respectively. The Macro Assembler is priced at $100 and Fortran is $350. The USCD P-system from SofTech Microsystems was pre-announced when the Personal Computer was announced, and is scheduled for availability in April with a price of $625. There are two versions. One comes with Pascal and the other with Fortran. You can add the other compiler for an additional $175.

The accounting package is called *General Accounting* and is from BPI. It was scheduled for availability in February with a price of $425. It is designed for very small businesses or professional offices and includes general ledger, accounts receivable/payable, payroll, and inventory.

There are four educational programs, available in December (1981). They are: *Fact Track* from SRA, at $90; *Arithmetic Games* set 1 and 2 also from SRA, each $60; and *Typing Tutor* from Microsoft, at $25.

By the way, prices I quote are IBM's prices, what you would pay if you bought the product in an IBM Product Center. Computerland and Sears prices may differ, either up or down. Also, Computerland and Sears may sell the product direct from the manufacturer, with a different packaging and price. Check around for the best deal, if possible.

Operating Systems

You'll recall that IBM offers their own operating system for the IBM Personal Computer, called DOS, supplied to IBM by Microsoft. Microsoft calls the system MS-DOS, and plans to market it themselves. Lifeboat Associates has also recently announced a product called SB-86 for the Personal Computer. Each of these products will probably be priced differently and have different things on the diskette. The important fact to remember is that *the operating system in each of these environments is identical.* A program that runs in the IBM DOS will run in SB-86 with no changes, and the same is true for MS-DOS.

I haven't gotten detailed information on either the Lifeboat or Microsoft offerings yet. I've been very interested in SB-86 but Lifeboat has not been very helpful so far. SB-86 is supposed to be delivered with utility programs, including one for conversion of 8080 assembly language source code into 8086 source code. Such a program has been available for some time from Intel, but I don't know if this is the same one or a new product.

In any event, the availability of this program is important for CP/M software vendors who are interested in converting to the IBM system. The only firm piece of information I've gotten is that SB-86 is currently an OEM product, but that it will eventually be offered at the retail level.

Getting at ROM and Others

Last month I talked about accessing memory anywhere in the physical address space of the machine through the use of Basic statements. As promised, I have produced a small program to demonstrate this feature.

Before we can get to that, however, I need to correct a typo (of mine) from last month. I said that the address used in a DEF SEG statement had to be evenly divisible by 16. This is not true. What I should have said was that *segments* in the 8088 have to begin on address boundaries which are evenly divisible by 16.

The address in a DEF SEG statement can be any value from &H0000 (0) to &HFFFF (65535). For PEEK, POKE, and the other statements I listed last month, Basic takes the DEF SEG value, *multiplies it by 16*, and adds it to the offset provided in the PEEK, POKE, or other statement to form a 20-bit physical address. The act of multiplying the value by 16 obviously ensures that it will be evenly divisible by 16.

The 8088 processor supports one million (actually 1,048,576) bytes of memory. The processor has an instruction set which allows it to access this memory directly. However, since the registers in the CPU are only 16 bits wide, there is a problem constructing the longer 20-bit address. The problem is solved in a manner similar to that used in

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CIRCLE 290 ON READER SERVICE CARD

IBM, continued...

the IBM 360/370 architecture.

A special set of 16-bit registers is used to define "segments" of memory. Each machine instruction denotes both one of these segment registers and its own "offset." The CPU creates the physical address by multiplying the segment register value by 16 and adding the offset given by the instruction.

Interpreting this is a little tricky. It is tempting to view the memory of the computer as a series of 65536 segments, each 16 bytes long, since this most accurately models the way the CPU forms addresses. However, 16 byte segments are pretty small. I prefer to view the memory as 16 segments (numbered 0 to F) of 65536 bytes each. For one thing, this makes the hexadecimal represention of the segment addresses for Basic programs simple, in that they range from &H0000 to &HF000 in &H1000 increments.

The physical address calculation is so simple you can do it in your head without even adding. For example, offset &HFA6E in segment &HF000 has physical address FFA6E (F0000 + FA6E)—the most significant digit is the segment number and the other digits are the offset.

Sometimes it won't be possible to use such "clean" segment addresses. Suppose you wanted to POKE something directly into the Color Graphics Adapter memory, which begins at physical address B8000. Now it's just not intuitive to set the segment to &HB000 and then POKE at &H8000+ &Hxxxx, where xxxx is the actual offset in the adapter memory. In this case, it makes better sense to set the segment to &HB800 and then use actual offsets.

In any event, I've prepared a program that reads the pattern for a given character from the ROM BIOS and draws it on the screen with block characters. The program is shown in Listing 1. It will run using either the monochrome display or the color adapter. In the case of the color adapter, you should change line 1310 to make the width of the screen 40 instead of 80.

The program defines all variable names to be integers (line 50). This is not necessary, but it makes the program run a little faster. The "dot" is defined to be a character (line 60), in this case a solid block. In line 100 I've selected the highest segment and in line 110 I've indicated that the base address of the character pattern table is &HFA6E. Each character is displayed in an 8 x 8 pixel box, so 8 bytes are used to store the patterns (line 120).

In lines 200 to 230, the screen is cleared and the program awaits a single key depression which is used as an index into the character table. In line 240 the actual address in segment &HF000 is calculated.

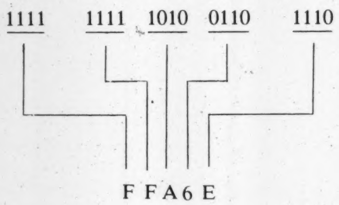
On Hexadecimal Numbers and Notations

In this month's column I have made use of hexadecimal numbers and some notations which represent them. I want to be sure you all understand what it's all about.

Everyone is familiar with the decimal numbering system. That's what we use every day for everything, like how many dollars it took to buy how many gallons of gasoline. The system is called decimal because there are ten unique digits. However, this is only one *representation* of numbers. You probably know that computers speak binary, a numbering system with only two digits. Binary is very cumbersome to use in most cases. For example, the representation of the physical address of the character table in the ROM BIOS is 1111111110 1001101110.

It's a lot easier to use a more compact representation, such as decimal. Programmers, however, often need to know or understand the placement of bits in the numbers they work with. The hexadecimal numbering system, with sixteen unique digits, solves the problem elegantly. Since each hexadecimal digit can take on one of 16 values, exactly four bits can be represented by each digit. This allows the bit patterns of numbers represented in hexadecimal to be rapidly determined. The digits used are 0 through 9, to represent their decimal equivalents, and A through F, to represent the values 10 through 15, respectively.

Let's work this backwards. Taking the binary address from above, we can organize it into groups of four bits. These four bit numbers can be converted to a hexadecimal digit. The result is a hexadecimal number.



In this column, and in practice, the hexadecimal representation will normally be used only for addresses, machine language instructions, or bit patterns.

There is one problem to overcome. How can you tell what I mean by the number 4567? Is it decimal, or is it hexadecimal? Or is it something else entirely? Unless it is obvious through context, I will use the notation of the programming language under discussion. If it is not a programming issue, then I will use the Basic notation, as I have done in this column. In Basic, hexadecimal numbers are denoted by the prefix "&H" and all digits which follow with no intervening spaces are taken to be hexadecimal digits.

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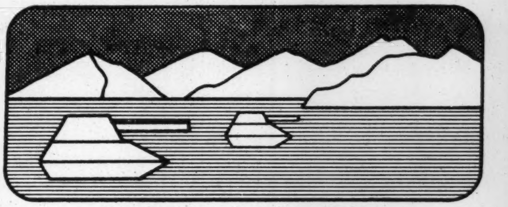

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7 Industry Leaders Offer Their Views

The Future of Personal Computers

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- **Philip D. Estridge**. Director, Entry Systems Business, International Business Machines, Boca Raton, Florida. Mr. Estridge—the creator of IBM's new personal computer—looked into the near future and "The Next Steps for Personal Computers."

- **H.E. James Finke**. President, Commodore International, Ltd., Norristown, Pennsylvania. Mr. Finke gave his perspective on the explosive growth of microcomputers with "The Mass Market Micro: The Future Ain't What It Used to Be."

- **William H. Gates**. President, Microsoft, Bellevue, Washington. Mr. Gates—the father of microcomputer software—provided an inside look at "Things to Come in Personal Computer Software."

- **A.C. (Mike) Markkula**. President, Apple Computer Inc., Cupertino, California. Mr. Markkula examined forthcoming breakthroughs in personal computer technology in his talk "Making Computers Easier to Use: Trends in the User Interface."

- **Peter Rosenthal**. Marketing Manager, Atari Computer Division, Sunnyvale, California. Mr. Rosenthal offered a vision of "The Home Computer of the Future" and its impact on our homes.

- **Jon Shirley**. Vice President, Radio Shack Computer Merchandising, Fort Worth, Texas. Mr. Shirley explored the business applications of future computers with "Personal Computers in the Office of the Future."

- **Nigel Searle**. Vice President, Sinclair Research Ltd., Cambridge, England. Mr. Searle considered the impact of personal computers on consumers in his talk "The Consumer Marketplace for Future Personal Computers."

Moderated by Jonathan Rotenberg, President, The Boston Computer Society.

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IBM, continued...

The screen is cleared (line 250), a position for display is selected (300, 310), and the character is displayed (line 320). Then the whole thing is done again.

The character display subroutine at line 1000 simply reads the bit patterns from memory using PEEK statements and, one bit at a time, looks for bits that are set. Every time it sees one, it calls the subroutine at line 1200 to move to the proper screen position and display a dot.

I had some fun with this program by changing line 60 to ask for a value instead of just using 219. This let me display the patterns using arbitrary characters for the "dot." There were some interesting results. I enjoyed the little smiling face, character code 1. It actually builds a reasonably attractive character, even up close.

If you want to fool around with this program, try modifying it to act like a big typewriter: that is, put the first character in the upper left hand corner of the display, the second right next to it, etc., until you fill a line, and then begin the next line. You can get three lines of 5 or 10 characters, depending on the display you have.

Another idea is to speed up the display subroutine by creating a table of column masks instead of calculating them every time. In line 1030, the exponentiation is done 64 times for each character. You'll see a noticeable difference in speed.

By the way, I want to thank Bob Roswell and Maury Weinstein of the Baltimore Computerland store for letting me use their IBM demonstrator to write the program and test it out. Remember Photo 1?

Books

If you intend to do any serious programming (other than Basic) for the IBM Personal Computer, you'll have to become more intimate with the processor. I've come across some books that may help you. Here's the list.

The 8086 Book by Russell Rector and George Alexy, 1980, Osborne/McGraw-Hill, Berkeley, CA.

The 8086 Primer: An Introduction to Its Architecture, System Design, and Programming by Stephen P. Morse, 1980, Hayden Book Company, Rochelle Park, NJ.

The 8086 Family User's Manual, October 1979, Intel Corporation, Santa Clara, CA.

iAPX 88 Book, July 1981, Intel Corporation, Santa Clara, CA.

Technical Reference, IBM Personal Computer Hardware Reference Library, November 1981, IBM Corporation, Boca Raton, FL.

If you're very experienced and understand Intel assembly languages already, you can make do with either Intel publication. If you are starting from ground zero, you'll want one of the first two books above. I personally like the Rector/Alexy book because it explains very carefully and clearly how the CPU works and how each individual instruction works. The explanation given for each instruction is excellent—the best treatment I have seen. There are many tables and charts showing how the instructions group together in various ways.

Neither the Rector/Alexy book nor the Morse book does a very good job relating the instruction set to the assembly language syntax, but I'd give a slight edge to Morse. You'll need to supplement either book with the assembler reference manual for the IBM Macro Assembler or whatever assembler you happen to buy.

If you are going to program "outside" the DOS or Basic environments, you really should have a copy of IBM's Technical Reference Manual. It contains needed information about what's where in memory and how all the devices work, particularly the Color Graphics Adapter. It lists for $36 from IBM or a dealer.

If you have the Technical Reference and the Rector/Alexy book, you'll be in good shape.

Reports

I was fortunate to have an opportunity to read a rather large report about the impact of the IBM Personal Computer. It is titled "IBM's Billion Dollar Baby: The Personal Computer" and was written by Dr. Portia Isaacson and Dr. Egil Juliussen of Future Computing, Inc. I found the report interesting and informative in a number of dimensions. It was certainly interesting to note Future Computing's prediction of IBM's market share by 1985 (almost 30% to IBM, in the teens for Apple and Radio Shack), their forecast (almost 100,000 sold by the end of 1982, 860,000 by the end of 1985), and their comparison of the IBM system with others, most notably Apple.

There are two parts of the report which I think are particularly significant. The first is the excellent discussion of software compatibility and why the IBM system falls in the CP/M category. The other is Chapter 6, entitled "How IBM Will Change the Personal Computer Industry." Each section in this chapter describes the impact of the Personal Computer on a particular segment of the industry, such as word processing manufacturers, personal computer manufacturers, third-party software firms, etc. There is also a section describing the impact of the machine on large corporations.

There are many reasons to read this report. One of the most compelling is the background information which describes the personal computer industry. If you are just getting your feet wet with small systems, the report might help to sort things out.

Future Computing can be reached at 634 S. Central Expressway, Richardson, TX 75080. The report costs $450.

My Face is Red Department

I'm human. I hope you can be divine about these errors I've already made, and those I'll probably make in the future.

In my evaluation article I said that the BIOS did not have diskette support. It does—it has the I/O driver software. This is very low level stuff and does not appear to include any knowledge of file systems or DOS.

In my evaluation article I complained about the lack of DATE$ and TIME$ in cassette Basic. There is a reason for this—the same clock that the system uses to maintain the time of day is needed to operate the cassette recorder. Therefore, if you were running a time-of-day clock *and* read the cassette, the time would end up wrong.

In my evaluation article I mentioned that multiple pages of text could be stored in the Color Graphics Adapter. This is true, but I was wrong by a factor of 2: in 25 x 40 mode there are eight pages, not four, and in 25 x 80 mode there are four pages, not two. I'll have more on the guts of this adapter in a future column.

Also, in my evaluation article I said that any circle or ellipse could be drawn with the CIRCLE statement in Basic. In fact, ellipses are created by specifying an "aspect" parameter in the statement. This affects the ratio between the x-radius and the y-radius, and is used to offset the fact that in various resolutions on various display devices the dots may not have the same vertical and horizontal dimensions.

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Thus, if you draw a circle that looks squished, you can change the aspect ratio to make it look rounder. It also means that an ellipse *cannot* be drawn in any direction, but only with its major axis perfectly vertical or horizontal. If you read the Basic manual and play with the CIRCLE statement, you'll see what I mean.

Next month, I'll tell you some things I *don't* like about the IBM Personal Computer, and why. Until then, Happy St. Patrick's Day! ☐

Listing 1.

```
10 REM Program to display dot
   matrix characters from ROM
   patterns
20 REM Will Fastie -- 19 Nov 81
50 DEFINT A-Z
60 DOTCHAR=219
70 DOTSIZE=1
80 DOT$=STRING$(DOTSIZE,DOTCHAR)
90 GOSUB 1300
100 DEF SEG=&HF000
110 BASEADR=&HFA6E
120 BYTESPERCHAR=8
130 KEY OFF
200 CLS
210 CHAR$=INKEY$: IF CHAR$=""
    THEN 210
215 IF CHAR$=" " THEN STOP
220 CODE=ASC(CHAR$)
230 IF CODE >= 128 THEN BEEP:
    GOTO 200
240 ADR = BASEADR+
    (CODE*BYTESPERCHAR)
250 CLS
300 X=8
310 Y=(SCREENWIDTH-(8*DOTSIZE))/2
320 GOSUB 1000
330 GOTO 210
1000 FOR ROW=1 TO 8
1010    ROWVAL=PEEK(ADR+(ROW-1))
1020    FOR COL=1 TO 8
1030       COLMASK=2^(7-(COL-1))
1040       IF (ROWVAL AND COLMASK)
           <> 0 THEN GOSUB 1200
1050    NEXT COL
1060 NEXT ROW
1070 LOCATE 1,1
1080 RETURN
1200 REM Locate to bit position
     and display giant pixel!
1210 LOCATE X+(ROW-1),Y+(COL-1)
     *DOTSIZE
1220 PRINT LEFT$(DOT$,DOTSIZE);
1230 RETURN
1300 REM Initialize display
1310 SCREENWIDTH=80
1320 RETURN
```

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Graphics Seven Plus

David and Sandy Small

First came the TRS-80, Model I. It provided character-oriented graphics.

Next came the Apple. It provided both character and line graphics (one or the other).

Now we have the Atari. It provides 14 graphics modes, some character-oriented, some line-oriented.

"Fourteen modes?" you say. "The Basic manual lists nine." Well, that's because Basic only allows you to access nine directly. However, there are others lurking within the machine waiting for a programmer to find them. All are variations on the available modes, some quite useful. One is so useful that this article will be devoted to discussing its use.

All character-line graphics on the Atari ("playfield graphics") are generated by the close co-operation of two chips, Antic and CTIA. Antic fetches data for 3.7 million points per second (320 per line x 192 lines x 60 per second) and feeds it to CTIA which generates the TV picture from that data. To determine what sort of image should be generated (character, line, pixel size, etc.), Antic looks to his program, the display list. This program coexists in memory with all the usual Basic and 6502 programs. Anyway, his program, composed of individual instruction codes, tells him what sort of image to generate.

There are 14 image-generating codes in Antic's program. Now when Basic was designed, for some reason it was decided to allow access to only nine of these codes, rather than the full 14. And in particular, the highest resolution four-color mode was left out. This is "graphics 7+" (also known as "graphics seven-and-a-half.")

We got a great deal of mail from people asking how to use this graphics mode when we documented its existence back in the July 1981 *Creative*. (If you wish to see a tutorial on the Atari for the Basic programmer, go back to the June issue and read the "Outpost" columns to date. Sadly, we can't explain how Antic and such work in each article because the explanation is so long, but we can refer you to previous issues to get a background.)

It takes a bit of work and a fair grasp of what goes on inside the Atari, but the results are well worth it: in the highest four-color mode, we can get double the resolution of graphics 7 using graphics 7+.

Graphics 7, you will recall, gives us 96 vertical x 160 horizontal pixels in four colors. Graphics 8 gives us 192 vertical x 320 horizontal, but only in one color. Graphics 7+ gives us 192 vertical x 160 horizontal in four colors.

This is an extremely useful mode. Graphics 8 has several disadvantages; single dots sometimes become red or blue when white was intended because of "artifacting," and candy-stripes tend to appear on all near-vertical lines. Graphics 7 has pixels the size of 2 x 2 graphics 8 dots, and is too "chunky" for really accurate graphics. Graphics 7+, with double the vertical resolution, brings us close to the limits of most monitors in terms of color resolution, with 2 x 1 graphics 8 dots. No artifacting, no funny stripes, just nice colors in truly high resolution.

I should also mention that the graphics 7+ resolution is equal to the resolution of a player or missile at size x1.

Here at Houston Instruments, where I work, we have a project going to interface a plotter, capable of eight colors, to a digitizer. The image to be plotted must be displayed on the TV. Graphics 7 resolution is unacceptable; the individual pixel is too large for a quality display. But graphics 7+ provides twice the resolution while retaining the four colors of data. (Now, you'd like to know how I plan to get eight colors, right? I must confess to having a few sneaky ideas how to do so, and I promise to document the method should I succeed.) However, for now, four colors at 160 x 192 will do nicely.

A Look at Graphics 7 and 8

Graphics 7+ is midway between 7 and 8, so let's look at 7 and 8 to help understand how to generate 7+.

Graphics 7 is a "four color" mode. This means that for every point on screen, two bits of information are saved in memory. Depending on which of the four numbers possible is saved in those two bits, one of four color registers is selected to display color. (Actual color information is not saved in the display memory; rather, a color register number is saved, with the actual color being stored in the register.) Hence, one byte (eight bits) in graphics 7 display memory, looks like this:

ww xx yy zz

where w, x, y, and z are the information for a given point on screen.

The memory is mapped starting from the upper lefthand corner of the screen, from the beginning of display memory, across the screen, down one line, and so

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on. Hence, since we have 96 x 160, or 15,360 points, and four points stored per byte, we use 3840 bytes of data.

When Antic generates graphics 7 he does two scan lines of the same data. Hence, each Antic instruction generates two scan lines, and 96 of these instructions generate 192 lines—the height of the screen.

In graphics 8, we only save one bit of information per point. That bit is used to determine at what intensity a point is plotted, and where the background color and intensity and foreground intensity are stored in color registers. Since only one bit is saved per point, a graphics 8 display memory byte looks like this:

a b c d e f g h

where each letter represents one point. There are 320 x 192 points, 8 to a byte, which comes out to 7680 bytes of data.

Each graphics 8 Antic instruction generates one scan line, so there are 192 of them to a full screen.

Now graphics 7+ has the same vertical resolution as graphics 8—one line per Antic instruction. It also has the same horizontal resolution as graphics 7 (160), and the four colors. Do you begin to see why it is such a useful mode?

Note that different information must be written into display memory to draw a line in a different mode. In particular, in graphics 7 or 7+ two bits must be written for each pixel, whereas in graphics 8 one bit must be written. This will be very important shortly. An operating system routine, stored in the ROM plug-in cartridge, handles all of the bit-shifting and masking to write the required bits into memory, based on what graphics mode it thinks it is in.

Time for some sample programs: The first generates a simple graphics 7 display. The next generates a simple graphics 8 display. This is to allow you to compare the resolutions. See Programs 1 and 2.

Program 1.

```
10 REM PROGRAM 1 -- DAVE SMALL
20 REM PROGRAM TO GENERATE GR.7
30 REM SAMPLE DISPLAY
40 REM
50 REM 8K BASIC VERSION
60 REM
70 GRAPHICS 7
80 COLOR 1
90 PLOT 1,1
100 DRAWTO 159,1
110 COLOR 2
120 DRAWTO 159,80
130 COLOR 3
140 DRAWTO 1,1
141 FOR Z=1 TO 20
142 COLOR (INT(RND(0)*3)+1)
143 PLOT (INT(RND(0)*159)),
    (INT(RND(0)*80))
144 NEXT Z
150 PRINT "NOTE EACH GRAPHICS
    7 PIXEL"
160 PRINT "USES TWO SCAN LINES."
170 GOTO 170
```

Program 2.

```
10 REM PROGRAM 2 -- DAVE SMALL
20 REM PROGRAM TO GENERATE GR.8
30 REM SAMPLE DISPLAY
40 REM
50 REM 8K BASIC VERSION
60 REM
70 GRAPHICS 8
75 SETCOLOR 2,0,0
80 COLOR 1
90 PLOT 1,1
100 DRAWTO 159,1
120 DRAWTO 159,80
140 DRAWTO 1,1
141 FOR Z=1 TO 20
142 COLOR (INT(RND(0)*3)+1)
143 PLOT (INT(RND(0)*159)),
    (INT(RND(0)*80))
144 NEXT Z
150 PRINT "NOTE EACH GRAPHICS
    8 PIXEL"
160 PRINT "USES ONE SCAN LINE."
170 GOTO 170
```

Program 3.

```
10 REM PROGRAM 3
20 REM
30 REM CONVERT GR.7 TO GR.7+
40 REM DAVE SMALL
50 REM 8K BASIC VERSION
60 REM
70 REM CREATE IMAGE
530 REM *************************
540 REM ** FROM
    CREATIVE COMPUTING..
545 REM ** GENERATES MULTICOLOR
    SPIRAL
550 GRAPHICS 7:DEG :DIM C(3)
555 PRINT "CREATING IMAGE."
590 R=20:COLOR 1:C=1
600 X0=79:Y0=47
610 FOR K=0 TO 3:C(K)=K+1*2:NEXT K
620 FOR K=1 TO 3
630 X=X0+R*COS(360):Y=Y0:PLOT X,Y
640 FOR I=0 TO 5*360 STEP 75
650 X=X0+R*COS(I):Y=Y0+R*SIN(I)
660 DRAWTO X,Y
665 C=C+1:IF C>3 THEN C=1
667 COLOR C
670 NEXT I:R=R+12
680 NEXT K
690 Z8=1
700 PRINT "MODIFYING DL."
1000 REM GR.7 TO GR.7+
1010 START=PEEK(560)+256*PEEK(561)
1020 POKE START+3,14+64:REM LMS
1030 FOR Z=START+6 TO START+6+96
1040 IF PEEK(Z)=13 THEN POKE Z,14
1050 NEXT Z
1059 REM REMOVE THIS STOP
     FOR LOOP..
1060 STOP
1100 REM GR.7+ TO GR.7
1110 FOR Z=START+6+96 TO START+6
     STEP -1
1140 IF PEEK(Z)=14 THEN POKE Z,13
1150 NEXT Z
1155 POKE START+3,13+64:REM LMS
1160 GOTO 1020
```

Next, we will take a graphics 7 display and convert it to graphics 7+.

What will happen? Well, first, since we have 96 instructions in graphics 7, each generating two scan lines, we get a total of 192 scan lines. If each of those 96 instructions generates only one scan line, as in graphics 7+, the screen will only be half filled (only the top 96 scan lines). The same display that graphics 7 had in it will be retained, it will just shrink vertically.

So for our third program, let's take a graphics 7 display, and convert it to graphics 7+. You'll see the effect of doubling your vertical resolution, and won't believe how fine a line can be drawn in four colors. All we'll do is take the 96 bytes of Antic's program, when he's in graphics 7, and convert them from an Antic code 13 (graphics 7) to a 14 (graphics 7+). See Program 3.

Pretty neat, right? Nice resolution. Now if we could only get the whole screen in that resolution.

Well, we can. We could go the tough way, where we allocate memory, build 192 graphics 7 (14) instructions, set memory pointers to display memory, *ad infinitum*. Were we working in assembly language, we would have to do it that way. But there's an easier way: take an existing display list and convert it. That way Basic has already allocated memory space and so forth, and we don't need to worry about fooling it into leaving memory alone.

We can take a graphics 8 display list, already 192 instructions long, and convert the 15's (Antic code for graphics 8) to 14's. That part is easy, just a FOR-NEXT loop to convert every 15 to a 14. The only slightly tricky part is catching the LMS instructions (64 + 15 or 79), changing them to 78, and leaving the display memory data bytes alone. (See August 1981 for a discussion of LMS). This way, the right amount of screen memory is already reserved for us, the display list is set up, pointers and all, and we've saved a great deal of work.

Next, since graphics 8 uses a different bit pattern to display material, we'll have to fool the operating system into thinking we're really in graphics 7 so it uses the graphics 7 bit/shift routines. This is a matter of one POKE to the low memory location where the operating system looks each time it does a line draw to determine what graphics mode it is in. The location contains the graphics number currently in effect. We will, thus, POKE a 7 in there; it should currently contain an 8 from when graphics 8 was set up.

Well, here we go. (See Program 4.) We set up graphics 8, change the display list to graphics 7+, and do a three-color draw at the top of the screen. No problem, works fine. But when we try to draw anywhere in the lower half of the screen, we get an ERROR #141—cursor out of range.

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CIRCLE 244 ON READER SERVICE CARD

Program 4.

```
 10 REM PROGRAM 4
 20 REM
 30 REM CONVERT GR.8 TO GR.7+
 40 REM DAVE SMALL
 50 REM 8K BASIC VERSION
 60 REM
 65 DIM C(3)
 70 REM DISPLAY LIST MODS
 80 GRAPHICS 8
 90 PRINT "CONVERTING DL
    FROM 8 TO 7+."
100 START=PEEK(560)+256*PEEK(561)
110 POKE START+3,14+64
120 FOR Z=START+6 TO START+6+192+6
130 IF PEEK(Z)=15 THEN POKE Z,14
140 IF PEEK(Z)=15+64 THEN POKE Z,
    14+64:Z=Z+2:REM
    (SKIP LMS DATA BYTES)
150 NEXT Z
200 REM
210 REM LET OS THINK WERE IN GR.7..
220 POKE 87,7
390 PRINT "CREATING UPPER
    HALF IMAGE"
400 YADD=1
410 GOSUB 500
420 PRINT "CREATING LOWER
    HALF IMAGE"
425 YADD=30
430 GOSUB 500
440 STOP
500 REM
530 REM *************************
540 REM ** FROM CREATIVE COMPUTING..
545 REM ** GENERATES
    MULTICOLOR SPIRAL
550 DEG
590 R=10:COLOR 1:C=1
600 X0=79:Y0=47
610 FOR K=0 TO 3:C(K)=K+1*2:NEXT K
620 FOR K=1 TO 3
630 X=X0+R*COS(360):Y=Y0:PLOT
    X,Y+YADD
640 FOR I=0 TO 5*360 STEP 75
650 X=X0+R*COS(I):Y=Y0+R*SIN(I)
660 DRAWTO X,Y+YADD
665 C=C+1:IF C>3 THEN C=1
667 COLOR C
670 NEXT I:R=R+12
680 NEXT K
690 Z8=1
700 RETURN
```

Many, many people have tried the above routine to get into graphics 7+. All of them have run into this problem. You see, the operating system, while drawing a line, constantly checks to see if the line is going off of the visible area. Should it do so, an ERROR 144 is returned and the line drawing process stops. The OS thinks we're in graphics 7 (96 x 160), so when we try to draw below line 96, it thinks it is at the bottom of the screen and terminates the draw. In computerese this is known as "bounds checking"—and anyone who has watched football knows what "out of bounds" means. (See, these computer snob words really do have humble beginnings).

What Do We Do?

We can't POKE an 8 into the OS location, because then the draw routine will use the wrong bit shifting routine and we'll get all sorts of crazy bit patterns and colors. (Feel free to try it—there are many interesting effects obtainable this way. Just delete the POKE 87,7 in Program 3.) And we can't get by with a POKE 7...because then the OS thinks we're going out of bounds. Because both bounds checks and draw routine selection are based on the same location, we're stuck. (The memory location is called DINDEX and is located at 57 hex or 87 decimal).

The problem resides in the extreme care taken to avoid out-of-bounds conditions. If we could draw out of bounds, and have the Atari blindly do the draw instead of telling us we were wrong, then graphics 7+ would work. Even though the operating system might conclude that we were out of our minds and drawing off the bottom edge of the screen, it would continue to draw in the right places for our graphics 7+ to work. (Screen memory, by the way, is 3780 bytes in graphics 7 and 7680 in graphics 7+. Graphics 7+ and graphics 8 use the same memory size.)

Well, the OS routine is in ROM and cannot be modified, short of pulling the chips out and putting new ones in. As I am no hardware expert this solution isn't acceptable. Besides, if I did, my programs would run only on my machine. However, it did bring to mind an analogy which solved the problem. Character sets are stored in ROM, also, and are unmodifiable, unless they are copied into RAM first. So why not copy the OS draw routine into RAM, zap the bounds check, and use it for graphics 7+?

To make a long story even longer, that's what I did. The rest of the article describes this process. The first time through, I did it all in Basic, but that was too slow, so I recoded the slow parts in 6502 assembler. Those routines I used in the graphics 7+ driver. (They should be usable in any graphics mode; they just ignore all bounds checks. However, the Atari caution extends beyond overprotecting the user; a line drawn out of bounds could go sailing straight through memory reserved for other things, and crash the Atari. Just be careful; don't try to draw from 1,1 to 3000,6700.)

The final result is three assembly routines. They are fast and efficient and both fit into page 6 in memory (600-700 hex), 256 bytes set off by Atari for a user's own purposes and left untouched by Atari routines. The first modifies the graphics 8 display list to a graphics 7+. The second copies the OS draw routine into free RAM for modification. I use Basic for the small amount of POKEing that must be done in the OS routine to make it work properly in its new memory location (it involves relocating a few addresses) and to DRAW a line using the OS routine (it just takes arguments from the Basic USR call and feeds them to the draw routine).

To use graphics 7+, one does a graphics 8 call, calls the first USR routine to set up the 7+ display list, calls the second routine to fetch the draw routine in RAM and modify it, and then all is ready. Line draws are made in one of two forms:

X=USR(third routine,X coordinate, Y coordinate, color #) or X=USR(third,X1, Y1,X2,Y2,COLOR)

The first performs a DRAWTO from the old cursor location to the specified X and Y coordinates. The second performs a line draw between the specified points (equivalent to PLOT X1,Y1, : DRAWTO X2,Y2). Both routines perform the draw in the specified color, not the color of the current COLOR statement.

Alas, the OS draw routine is too long to fit into the small page 6. So it must be stored elsewhere in RAM. Finding a free space in RAM isn't too hard. However, finding a space that is free on *everyone's* Atari is pretty hard. Memory sizes range from 8K to 48K (40K with Basic cartridge). I decided to tailor the routine for my 40K system and let users do relocation as necessary for their own systems. Nowadays there is so much player-missile memory being reserved, charset arrays, and so forth that a general solution is very difficult.

For Advanced Programmers

The following is a bit technical but is intended for assembly programmers. The OS routines start at $FCFC and end at $FE44 (inclusive). They are copied to $7CFC through $7E44. Several JMPs inside are relocated back to the RAM routine, making this a non-relocatable routine. (The fact that I am copying it down an even $8000 makes it quite easy to relocate.) It should be simple to do this for other size memories; the calculations are self-documenting in the OS and assembly listings. Just make sure the JMPs are changed to JMP to the point in RAM where the

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mischa

"Relax, Hal, It won't replace you. It's not simple enough."

Atari SOFTWARE

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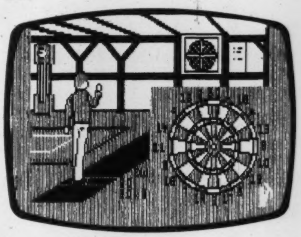

*Darts

Enter the pub, grab a pint of lager and a handful of darts, then try for a bull's eye in this amazing graphic game. One or two players can go at it, testing their aim at ten skill levels. Whether you want to throw a few, or just show your friends what the Atari computer can do, **Darts** is an ideal addition to your software library. This is Britain's most popular Atari game from Thorn/EMI. Order cassette CS-7011 $14.95.

*Billiards

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Atari, continued...

corresponding statement to the ROM statement is. Note that $7E44 is just below the DL/DM in a 40K or 48K (same thing with a Basic cartridge) machine. Hence it is in a relatively "safe" area.

The bounds check is a simple JSR. This is changed to NOP (no-operation) with three NOP codes.

Programs 5, 6, 7, and 8 are listings of four assembly/Basic routines. (The Atari OS listing is copyrighted and doesn't appear here, but you can easily look up the addresses specified to find where I am copying from yourself.)

Program 5 is the page 6 assembly listing. Program 6 is the assembly program converted to DATA statements. This program is appended to your code to load the assembly routine. Program 7 is the "Sunset" multiple color spiral run in graphics 7+, using an already loaded assembly routine, and provides an example of using graphics 7+ when the routines are loaded. Finally, Program 8 is an example of using the DATA statements of Program 6 to load and draw a pretty figure using graphics 7+.

Feel free to delete the REM statements; I document the code heavily in order to make it easy to understand, but the documentation isn't needed in the final copy. (I also break up all hex opcodes for clarity; these could be calculated to save the machine the work each runthrough.)

On using AUTORUN.SYS: This is a handy way for disk users to load these routines. Boot up DOS (2.0S), and run Program 6. Next, go to DOS. Do the binary save (K), from $600 to $6FF:

K

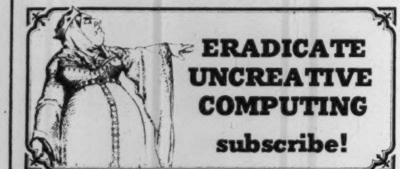
AUTORUN.SYS,600,6FF (return)

and thereafter when you boot up with that disk, the graphics 7+, routines will be loaded automatically.

Generally DOS and Basic will leave these routines alone once loaded unless you reboot the system or have a particularly nasty crash. Hence, even users without disks may not have to reload the data each program run.

Conclusion

Well, there you have it, graphics 7+. I hope to see more and more use of it! These routines can easily be copied into a AUTORUN.SYS file and automatically loaded along with Basic, or POKEd into memory when needed. Enjoy the world of double resolution graphics 7. ☐



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Program 5.

```
0         0250          *=    $0680
02FB          1390 ATACHR =     $2FB       COLOR DATA
05A          1340 OLDROW =     $5A       FROM Y
06FD 4CFC7C 1790          JMP  $7CFC       O.S...MUST MOD
10 ;
20 ; PROGRAM 5 LISTING..
22         1400 ICCOMZ =     $22        CIO DRAW FLAG
30 ;
40 ; THREE ASSEMBLY ROUTINES FOR
50 ; PAGE 6:
54         1370 ROWCRS =     $54        TO Y
55         1360 COLCRSL=     $55        TO X LO
56         1350 COLCRSH=     $56        TO X HI
57         1380 DINDEX =     $57        CURR GR. MODE
60 855C    1500          STA  OLDCOLH
68D 8D9706 0330          STA  FETCHH       (FETCH STMT)
69E D005   0520          BNE  NOT15
70 ; 1.CONVERTS DL FROM GR.8 - GR7.5.
80 ; 2.COPIER FROM OS ROM TO RAM.
90 ; 3.GR7.+ DRAWTO. FULL SCREEN
0100 ;   GR.7+ DRAW ROUTINE.
0110 ;
0120 ; COPYRIGHT 1981 BY DAVID M. SMALL
0130 ;
0140 ;-----------------------------
0150 ; ROUTINE 1:
0160 ; ASSEMBLY ROUTINE TO CONVERT
0170 ; A GR.8 DISPLAY LIST TO A GR 7.+
0180 ; DISPLAY LIST.
0190 ; CONVERTS ALL 15'S TO 14'S
0200 ; CONVERTS ALL (64+15) TO (64+14)
0210 ; (BUT WILL SKIP LMS DATA BYTES)
0220 ;
0230 ; PLACED IN PAGE 6.
0240 ;
0270 ;
0310 ;
0350 ;
0370 ;
0380 ; LOOP 202 TIMES. CHANGE 15 TO
0390 ; 15, 79 TO 78, SKIP LMS DATA.
0400 ;
0440 ;
0450 ; IF GR.2 ENCOUNTERED, QUIT --
0460 ; HAS A TEXT WINDOW.
0470 ;
0500 ;
0550 ;
0590 ;
0660 ;
0680 68     0260          PLA                 SATISFY BASIC
0681 AD3002 0280          LDA  560
0684 8D9606 0290          STA  FETCHL        (FETCH STMT)
0687 8DAC06 0300          STA  STOREL        (STORE STMT)
0690 ;
0693 A200   0360          LDX  #0             INIT X
0695 BD3412 0430 LOOP     LDA  $1234,X     GET DL BYTE
0696        0410 FETCHL =     *+1
0697        0420 FETCHH =     *+2
0698 C942   0480          CMP  #66
0720 ;
0740 ;
0750 ;---------------------------
0760 ; ROUTINE 2:
0770 ;
0780 ; COPIES O.S. ROM TO RAM (DRAW
0790 ; ROUTINES) TO ALLOW BOUNDS
0800 ; CHECK REMOVAL.
0810 ;
0820 ; COPIES $FCFC TO $FE44
0830 ;     TO $7CFC TO $7E44
0840 ;
0850 ; (THIS IS QUITE EASY TO CHANGE
0860 ;  TO CUSTOMIZE FOR YOUR ATARI;
0870 ;  ON A 40K-48K MACHINE THIS
0880 ;  IS RIGHT BELOW THE DL/DM.)
0890 ;
0900 ; (65092-64764=  328
0910 ; 328 - 256   = 72 )
0920 ;
0930 ;-- $FCFC TO $FDFB ($FF BYTES)
1010 ;               ,
1020 ;-- $FDFC TO $FE44
1100 ;
```

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Program 5, continued

```
1110 ; ----------------------------
1120 ; ROUTINE 3:
1130 ;
1140 ; THIS ROUTINE IS CALLED FROM
1150 ; BASIC TO PERFORM A DRAWTO
1160 ; FUNCTION IN GR 7.5. THERE ARE
1170 ; TWO POSSIBLE CALLS:
1180 ;
1190 ; D=USR(X1,Y1,X2,Y2,COLOR)
1200 ; D=USR(X2,Y2,COLOR)
1210 ;
1220 ; FIRST WILL DRAW A LINE BETWEEN
1230 ; THE SPECIFIED COORDINATES IN
1240 ; SPECIFIEDCOLOR. SECOND WILL
1250 ; "DRAWTO" FROM OLD LOCATION TO
1260 ; SPECIFIED COORDINATES.
1270 ;
1280 ; THIS ROUTINE REQUIRES THE O.S.
1290 ; DRAW ROUTINE BE COPIED INTO
1300 ; RAM AND MODIFIED. SEE ARTICLE.
1310 ;
1410 ; PULL OFF AND STORE ARGS
1480 ;
1560 ;
1610 ;
1650 ;
1690 ;
1700 ; SETUP IS DONE. OTHER MISC:
1710 ;
1760 ;
1770 ; CALL DRAW RAM ROUTINE
1780 ;
1800 END
6000 68     1510          PLA                 GET FROM X LO
060000 855B   1520          STA  OLDCOLL
```

Program 6.

```
9000 REM LOADER
9010 Z=6*256+8*16
9020 READ Z1
9030 IF Z1=-1 THEN RETURN
9040 POKE Z,Z1
9050 Z=Z+1
9060 GOTO 9020
10000 DATA 104,173,48,2,141,150,6,141,172,6,173,49,2,
     141,151
10010 DATA 6,141,173,6,162,0,189,52,18,201,66,240,29,
     201,15
10020 DATA 208,5,169,14,76,171,6,201,79,208,2,169,78,
     157,52
10030 DATA 18,232,201,79,208,2,232,232,224,203,144,220,
     96,162,0
10040 DATA 104,189,252,252,157,252,124,232,224,0,208,
     245,162,0,189
10050 DATA 252,253,157,252,125,232,224,75,208,245,96,
     104,201,3,240
10060 DATA 15,201,5,240,1,96,104,133,92,104,133,91,
     104,104,133
10070 DATA 90,104,133,86,104,133,85,104,104,133,84,
     104,104,141,251
10080 DATA 2,169,17,133,34,76,252,124
11000 DATA -1
```

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"Come to any conclusions on Murphy's Law yet?"

Program 7.

```
10 REM PROGRAM   -- ASSEMBLY VERSION
15 REM REQUIRES AUTORUN.SYS OR LOAD
20 REM
40 REM DAVE SMALL
50 REM 8K BASIC VERSION
55 REM
56 IF PEEK(1536+128)<>104 THEN PRINT "ASSEMBLY
   NOT LOADED..":STOP
60 REM DEFINES
61 CONVERT=6*256+8*16:REM $0680
62 COPY=6*256+11*16+10:REM $06BA
63 DRAW=6*256+13*16+6:REM $06D6
65 DIM C(3)
67 REM
70 REM DISPLAY LIST MODS
80 GRAPHICS 8
90 X=USR(CONVERT)
97 REM
200 REM
210 REM LET OS THINK WE'RE IN GR.7..
220 POKE 87,7
230 REM
300 PRINT "PERFORMING OS COPY."
310 X=USR(COPY)
320 REM RELOCATION
321 POKE (7*4096+13*256+9*16+8),(7*16+14):REM FD98,
    FE TO 7E
322 POKE (7*4096+14*256+2*16+6),(7*16+14):REM FE26,
    FE TO 7E
323 POKE (7*4096+14*256+4*16+1),(7*16+13):REM FE41,
    FD TO 7D
324 REM NOP OUT BOUNDS CHECKS
325 L=7*4096+13*256+15*16+6
326 FOR Z=L TO L+2
327 POKE Z,234:REM NOP
328 NEXT Z
350 REM
390 PRINT "CREATING FULLSCREEN IMAGE"
500 REM
530 REM ************************
540 REM ** FROM CREATIVE COMPUTING..
545 REM ** GENERATES MULTICOLOR SPIRAL
550 DEG
590 R=20:COLOR 1:C=1
600 X0=79:Y0=85
610 FOR K=0 TO 3:C(K)=K+1*2:NEXT K
620 FOR K=1 TO 3
630 X=X0+R*COS(360):Y=Y0+R*SIN(360)
636 Z=USR(DRAW,X,Y,X,Y,0):REM (PLOT)
640 FOR I=0 TO 5*360 STEP 75
650 X=X0+R*COS(I):Y=Y0+R*SIN(I)
662 Z=USR(DRAW,X,Y,C):REM (DRAWTO)
665 C=C+1:IF C>3 THEN C=1
670 NEXT I:R=R+20
680 NEXT K
690 Z8=1
700 STOP
```

Program 8.

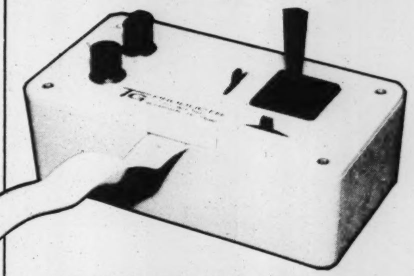
```
10 REM PROGRAM 8 -- DEMOS LOAD THRU
15 REM DATA STATEMENTS.
20 REM
40 REM DAVE SMALL
50 REM 8K BASIC VERSION
54 GOSUB 9000
55 REM
56 IF PEEK(1536+128)<>104 THEN PRINT "ASSEMBLY
   NOT LOADED..":STOP
60 REM DEFINES
61 CONVERT=6*256+8*16:REM $0680
62 COPY=6*256+11*16+10:REM $06BA
63 DRAW=6*256+13*16+6:REM $06D6
65 DIM C(3)
67 REM
70 REM DISPLAY LIST MODS
80 GRAPHICS 8+16
95 X=USR(CONVERT)
```

Program 8, continued

```
96 GOTO 200
97 REM
200 REM
210 REM LET OS THINK WE'RE IN
    GR.7..
220 POKE 87,7
230 REM
300 REM
310 X=USR(COPY)
320 REM RELOCATION
321 POKE (7*4096+13*256+9*16+8),
   (7*16+14):REM FD98, FE TO 7E
322 POKE (7*4096+14*256+2*16+6),
   (7*16+14):REM FE26, FE TO 7E
323 POKE (7*4096+14*256+4*16+1),
   (7*16+13):REM FE41, FD TO 7D
324 REM NOP OUT BOUNDS CHECKS
325 L=7*4096+13*256+15*16+6
326 FOR Z=L TO L+2
327 POKE Z,234:REM NOP
328 NEXT Z
350 REM
390 REM
400 SETCOLOR 0,2,4:REM RED
410 SETCOLOR 1,7,4:REM BLUE
420 SETCOLOR 2,13,4:REM GREEN
500 DEG
505 X2=SIN(0)*70+70:Y2=COS(0)
    *80+80
507 Z=USR(DRAW,X2,Y2,X2,Y2,0)
    :REM PLOT
508 C=1
510 FOR X=0 TO 360 STEP 4
520 X1=SIN(X*1.5)*70+70
530 Y1=COS(X*2)*80+80
531 X2=SIN(X+120)*40+60
532 Y2=COS(X-40)*50+60
540 Z=USR(DRAW,X1,Y1,X2,Y2,C)
545 C=C+1:IF C=4 THEN C=1
550 NEXT X
560 GOTO 560
9000 REM LOADER
9010 Z=6*256+8*16
9020 READ Z1
9030 IF Z1=-1 THEN RETURN
9040 POKE Z,Z1
9050 Z=Z+1
9060 GOTO 9020
9999 REM DATA FOR GR 7+ DRIVER
10000 DATA 104,173,48,2,141,150,6,
      141,172,6,173,49,2,141,151
10010 DATA 6,141,173,6,162,0,189,
      52,18,201,66,240,29,201,15
10020 DATA 208,5,169,14,76,171,6,
      201,79,208,2,169,78,157,52
10030 DATA 18,232,201,79,208,2,
      232,232,224,203,144,220,96,
      162,0
10040 DATA 104,189,252,252,157,
      252,124,232,224,0,208,245,
      162,0,189
10050 DATA 252,253,157,252,125,
      232,224,75,208,245,96,104,
      201,3,240
10060 DATA 15,201,5,240,1,96,104,
      133,92,104,133,91,104,
      104.133
10070 DATA 90,104,133,86,104,133,
      85,104,104,133,84,104,104,
      141,251
10080 DATA 2,169,17,133,34,76,
      252,124
11000 DATA -1
```

Why would anyone spend $59.95 for a joystick?

Super Joystick



Star Wars. Played with paddles, it's difficult at best and frustrating at worst. But with a joystick it becomes an entirely new experience. It's still challenging. It's also fun. And very addictive.

Have you ever used a drawing program in which one paddle controls the horizontal movement of the "brush" and the other paddle the vertical? It's slow, tedious work. But with a joystick, drawing is an absolute joy.

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The Super Joystick has a pure resistive circuit which is absolutely linear within one tenth of one percent. In other words it would give you precise control over an image of 1000 by 1000 pixels, were such resolution available. Thus it is suitable for high precision professional applications as well as educational and hobbyist ones.

Matched to your application

The Super Joystick also has two external trim adjustments, one for each direction. This allows you to perfectly match the unit to your application and computer. Say you want to work in a square area instead of the rectangular screen. Just reduce the horizontal size with the trim control.

How many times have you played Space Invader and had your thumb ache for hours from the repeated button pressing? This won't happen with the Super Joystick. It's two pushbuttons are big. Moreover, they use massive contact surfaces with a life of well over 1,000,000 contacts. A few games of Super Invader using these big buttons will justify the purchase of the Super Joystick.

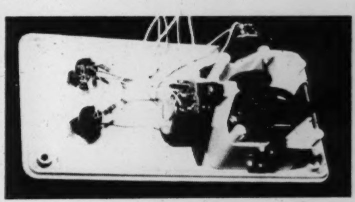
The Super Joystick is self-centering in both directions. That means when you take your hand off it, the control will return to the center. However, if you want it to stay where you leave it, self-centering may be easily disabled.

The Super Joystick plugs right into the paddle control socket and doesn't require an I/O slot.

High-quality construction

The sturdy high-impact molded plastic case of the Super Joystick matches that of the Apple computer. Every component used is the very highest quality available.

We invite your comparison of the Super Joystick with any other unit available. Order it and use it for 30 days. If you're not completely satisfied, return it for a prompt and courteous refund plus your return postage. You can't lose.



By removing two springs, self-centering can be defeated.

The Super Joystick consists of a self-centering, linear joystick, two trim controls, and two pushbuttons mounted in an attractive case. It comes complete with instructions and a 90-day limited warranty. Cost is $59.95.

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CIRCLE 239 ON READER SERVICE CARD

le cart...apple cart...apple c

Chuck Carpenter

Over the past months, I have received a few Pascal programs and comments. Some of the input was relative to previous items in the column (randomizing strings). One letter asked about how to print from a Pascal program. It seemed like it ought to be easy to do—it wasn't. Along with a variety of other Apple info, this column will include the semi-sometimes offerings from Rosa Pascal.

Rosa Pascal Sez

Printing from a Pascal program. For us mostly Basic programmers, that seems like it should be simple. Just use the equivalent of PR#1 or LPRINT or whatever works in the version of Basic you use. The question was asked by Jim Pittman. And, after much searching in the Apple manuals, no easily recognized way to print was found. By this time, there didn't seem to be an easy way to answer Jim's question. Then I started searching through the other manuals I have on Pascal programming. Nothing there either. The closest was a mention of the use of the write-in command with input/output routines. It was mentioned briefly in the *Pascal Primer* by David Fox and Mitchell Waite.

By this time I was almost desparate enough to call some of the local Pascal programmers. But not quite. Looking through several magazines for Pascal programs produced the answer. The programs found were documented well enough for me to understand how printing in Pascal is accomplished. So the techniques were sent along to Jim in hopes the question was answered. It was, and Jim returned a sample routine shown in Listing 1. Observe the last few lines of the program. These lines include the main program. This is how Pascal calls the various sub programs.

Listing 1.

```
  (*                         James C. Pittman Jr.                         *)
  (*                                                                      *)
  (*       Write out a table of ASCII characters to a printer             *)
  (*                                                                      *)
  (*   This is a sample Pascal program to demonstrate printing input and *)
  (*output from within a program.     See  article in NIBBLE, Vol 2, Nr 5,*)
  (*(1981)   page 119,  and  the  Apple Pascal  Language Reference Manual,*)
  (*pages  26-29 on  REWRITE,  RESET, and  CLOSE  procedures.  Thanks to  *)
  (*Chuck Carpenter for his suggestions.                  18 October 1981 *)
  (*                                                                      *)

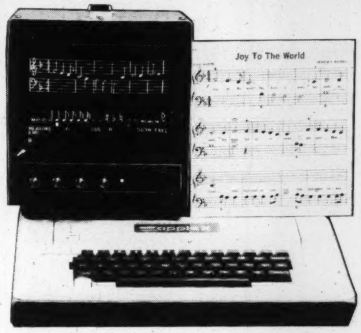
program     printest  (input,output);
var         x,y,z : integer;
            output : string[8];
            fid : interactive;

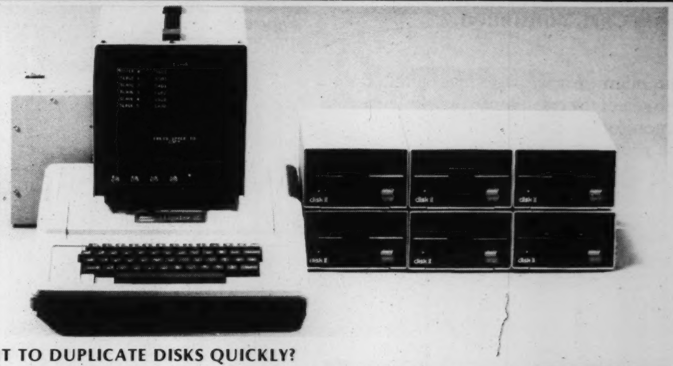
procedure   data;                            (*  Get "line width" input;  *)
begin                                        (*   try "15" for example.   *)
  writeln(fid);  (* "fileid" or identifier of a previously declared file *)
  writeln(fid,'Enter an integer between 7 and 26, or 0 to stop. ');
  readln(z); write(fid,'  (',z,')')
end;

procedure   display;                              (*  Write some output  *)
begin
  y := 0;                                       (* Initialize "line width" *)
  writeln(fid);
  for x := 32 to 127 do                    (* Print all the ASCII characters *)
  begin
    write(fid,' ',chr(x),' '); y := y + 1;
    if y > z then                                        (* Start new line *)
     begin
       y := 0;
       writeln(fid)
     end;
  end
end;

begin                                              (* Main part of program *)
  z := 1;
  while z <> 0 do                                     (* Stop if z = zero *)
  begin
    writeln;
    writeln('Select either <console:> or <printer:> ');
    readln(output);                   (* Don't make a typing mistake here! *)
    reset(fid,output);
    data;                                     (* Do the first "subroutine" *)
    if z <> 0 then
    display;                                 (* Do the second "subroutine" *)
    close(fid);   (* Must close the file so can go back and select again *)
  end                                                   (* End, z = zero *)
  end.
```

Chuck Carpenter, 2228 Montclair Pl., Carrollton, TX 75007.





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CIRCLE 187 ON READER SERVICE CARD

Apple Cart, continued...

In the main program Jim has included a way to select the console: (Apple keyboard and monitor) or the printer. A sample run of the program is included in Figure 1.

In the May '81 column, a short program by Ron DeGroat was included showing a way to randomize a string of characters. Two programs were received showing how to do similar things. Listing 2, submitted by Ronald A. Thisted, included a detailed discussion. (Much too long to include here, however.) The program itself is well annotated and experienced programmers should be able to understand the routine. Another program, shown in Listing 3, was contributed by Fred W. Hansen. Again, the program is well annotated. Since my Pascal skill is limited, the programs are included for your interest without explanation.

Figure 1.

```
Enter an integer between 7 and 26, or 0 to stop.
  (15)
    !  "  #  $  %  &  '  (  )  *  +  ,  -  .  /
 0  1  2  3  4  5  6  7  8  9  :  ;  <  =  >  ?
 @  A  B  C  D  E  F  G  H  I  J  K  L  M  N  O
 P  Q  R  S  T  U  V  W  X  Y  Z  [  \  ]  ^  _
 `  a  b  c  d  e  f  g  h  i  j  k  l  m  n  o
 p  q  r  s  t  u  v  w  x  y  z  {  |  }  ~

Enter an integer between 7 and 26, or 0 to stop.
  (7)
    !  "  #  $  %  &  '
 (  )  *  +  ,  -  .  /
 0  1  2  3  4  5  6  7
 8  9  :  ;  <  =  >  ?
 @  A  B  C  D  E  F  G
 H  I  J  K  L  M  N  O
 P  Q  R  S  T  U  V  W
 X  Y  Z  [  \  ]  ^  _
 `  a  b  c  d  e  f  g
 h  i  j  k  l  m  n  o
 p  q  r  s  t  u  v  w
 x  y  z  {  |  }  ~

Enter an integer between 7 and 26, or 0 to stop.
  (0)
```

Listing 2.

```
  PROGRAM JUMBLE (OUTPUT):
  (*
                          WRITTEN 30-APRIL-81
                          BY RONALD A. THISTED

      THIS PROGRAM ILLUSTRATES A GENERAL SHUFFLING ALGORITHM THAT CAN BE
  USED TO GENERATE RANDOM PERMUTATIONS OF ARBITRARY SETS OF OBJECTS.  IT
  IS ILLUSTRATED HERE ON THE CHARACTERS OF THE ROMAN ALPHABET.

      IN GENERAL, THE N OBJECTS TO REARRANGE RESIDE IN AN ARRAY OF LENGTH
  N; THE POINT IS TO SHUFFLE THE ITEMS IN THE ARRAY.  AT STEP 1, A RANDOM
  ITEM IS SELECTED TO OCCUPY THE LAST POSITION IN THE ARRAY.  THIS
  SELECTED ITEM IS THEN EXCHANGED WITH WHATEVER ITEM WAS ALREADY IN THE
  LAST POSITION.  AT THIS POINT, ITEM NUMBER N IS IN ITS FINAL RESTING
  PLACE, AND ALL OF THE REST OF THE ITEMS OCCUPY THE FIRST N-1 POSITIONS
  OF THE ARRAY.  STEP NUMBER 2 SELECTS A RANDOM ITEM FROM THOSE REMAINING
  TO OCCUPY THE NEXT TO LAST POSITION, AND THE CHOSEN ITEM IS THEN PLACED
  THERE.  AFTER STEP 2, THE LAST TWO ITEMS ARE IN THEIR HOMES, AND THE
  FIRST N-2 ITEMS REMAIN TO BE ASSIGNED A PLACE.  THIS CONTINUES UNTIL ALL
  ITEMS HAVE BEEN ASSIGNED.

      THE ALGORITHM IS DUE TO MOSES AND OAKFORD (TABLES OF RANDOM
  PERMUTATIONS, STANFORD UNIVERSITY PRESS, 1963). THIS ALGORITHM AND
  OTHERS RELATED TO IT ARE DISCUSSED IN KNUTH, THE ART OF COMPUTER
  PROGRAMMING: SEMINUMERICAL ALGORITHMS, VOLUME 2, SECOND EDITION (1980),
  ADDISON-WESLEY.                *)

USES APPLESTUFF;
CONST
      SETSIZE  =  26;   (* SIZE OF ROMAN ALPHABET *)
VAR
      I       : 1..SETSIZE;  (* LOOP COUNTER *)
      POS     : 1..SETSIZE;  (* POSITION OF SELECTED ITEM *)
      CH      : CHAR;        (* HOLDS AN ITEM TEMPORARILY *)
      OBJECTS : PACKED ARRAY [1..SETSIZE] OF CHAR;

BEGIN (* MAIN PROGRAM *)
    (* FIRST, INITIALIZE OUR SET OF OBJECTS AND GIVE THE APPLE RANDOM
       NUMBER GENERATOR A RANDOM STARTING POINT.  *)

    OBJECTS := 'ABCDEFGHIJKLMNOPQRSTUVWXYZ'; RANDOMIZE;
   (* NEXT, WE SHUFFLE.  ORDINARILY THE INSTRUCTIONS THAT FOLLOW
      WOULD RESIDE IN A PROCEDURE WHICH WE WOULD CALL HERE. *)

   FOR I:= SETSIZE DOWNTO 2 DO
      BEGIN
      POS := 1 + RANDOM MOD SETSIZE; (* SELECT LUCKY ITEM GOING TO BIN I  *)
      CH  := OBJECTS[I];             (* SAVE PRESENT OCCUPANT OF BIN I    *)
      OBJECTS[I] := OBJECTS[POS];    (* MOVE LUCKY ITEM TO ITS FINAL HOME *)
      OBJECTS[POS] := CH             (* THEN RE-USE THE VACATED BIN       *)
      END;
(* FINALLY, PRINT OUT THE SHUFFLED SET TO CONVINCE THE SKEPTICS. *)
      WRITELN(OBJECTS)
      END.
```

More Info

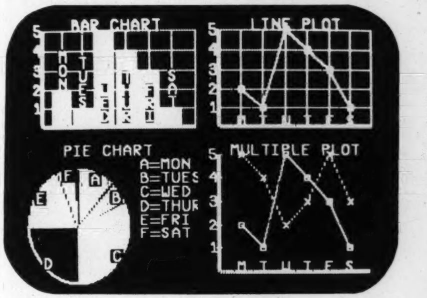
Apple owners can find information about their systems from a new source. A summary of over 100 books and magazines about the Apple and the Apple 6502 microprocessor is included in the *Apple Owners Book List*. If you're looking for information about the Apple, you should be able to find much of it here. The uncopyrighted list is $2.00 per copy and is updated monthly. Use and dissemination of the list is encouraged, according to its editor. Get your copy from Bob Broedel, P.O. Box 20049, Tallahassee, FL 32304.

String Art

For those who are just getting started with graphics, here's a program you will find interesting. The program, called "String Art" was written by Daniel Rice. Listing 4 is the program. According to Daniel, this is how it works: "Here is a small Applesoft program that draws interesting "String Art" patterns. It actually draws consecutive ovals, each differing slightly in angle and location. Thus, with a large scale, interweaving straight-line effects are created. Typing CTRL-C during execution returns the program to line 110. Any other character temporarily stops the program until another key is pressed. A negative response to the question in line 160 ends the program. On an Apple II Plus, or an Apple II with Applesoft card or language system, line 200 may be changed to HGR:HCOLOR=7. Line 270 contains an invisible CTRL-G between the quotes. Occasionally, the program may 'refuse' to draw a certain pattern. The solution is merely to re-run the program, and try again."

There are a couple of interesting features in Daniel's program. In lines 120 and 130 are included a series of POKEs. Line 120 POKES 6 bytes of data into consecutive addresses starting at 768 decimal or $0300

PLOT POWER



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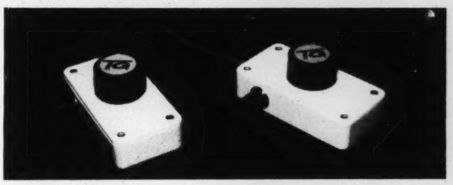
CIRCLE 113 ON READER SERVICE CARD

Super Paddle



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CIRCLE 208 ON READER SERVICE CARD

hex. (Remember that the $ symbol means hex in 6502 microprocessor notation.) The two POKES in line 130 are to addresses 232 and 233 decimal or $E8 and $E9. These two addresses are the pointer to the beginning of a shape table for hi-res graphics. The shape table is included in the data starting at address $0300. So, the pointer at address $E8-$E9 will be used by this graphics program to point to the shape table needed to draw the consecutive ovals. You can find out more about creating and using shape tables on pages 92 to 100 in the Applesoft Reference manual.

Daniel's use of the shape table is novel and creative. The use of POKEs to enter the table ensures that it is loaded each time the program runs. It is not described this way in the pages mentioned above. Since page 3 of the Apple memory usually is free, it is ideal for storage of small programs and data. Apple DOS uses memory from $03D0 to $03F0 or so. Anyway, you can use the memory up to $030F for your own purposes such as the shape table in this program. For testing of keyboard input, line 240 looks for the carriage return. Decimal 141 is $8D, the ASCII value of a carriage return. Note that in the Apple II, the high bit is set on all normal video characters. Other video attributes are invoked when this bit is changed. Line 270 then resets the strobe with the POKE and rings the bell. In line 280 the program is halted until any key is pressed. The keyboard strobe is reset again in line 290 and the program continues back at line 250. Typing a CTRL-G invokes an error condition which is trapped by the ONERR command in line 100. As you can see, lots of things happen, even in small programs.

Listing 3.

```
(*  PROCEDURE RANDOMIZES THE CONTENTS OF ANY STRING PASSED TO IT.
**  IT REQUIRES "USES APPLESTUFF" AND "RANDOMIZE" IN THE MAIN PROGRAM
**  BLOCK.
**
**  AUTHOR: FRED W. HANSEN
**  DATE  : 05/27/81
**
**  NOTES:
**
**     1. BYPASS PROCESSING IF THE INPUT SOURCE STRING IS NULL OR ONLY
**        ONE CHARACTER LONG;
**     2. INITIALIZE THE WORK STRING TO NULL.
**     3. RANDOMLY SELECT A CHARACTER (BY POSITION) FROM THE INPUT SOURCE
**        STRING;
**     4. PLACE THE SELECTED CHARACTER ON THE END OF THE DESTINATION
**        STRING;
**     5. REMOVE THE SELECTED CHARACTER FROM THE SOURCE STRING;
**     6. REPEAT THE PROCESS UNTIL THERE ARE NO MORE CHARACTERS LEFT
**        IN THE SOURCE STRING;
**     7. THE SOURCE STRING BECOMES THE NOW-RANDOMIZED DESTINATION
**        STRING.
*)
PROCEDURE SCRAMBLE (VAR SOURCE:STRING);

          VAR
            SELECTEDCHAR  : INTEGER;
            DESTINATION   : STRING;


          BEGIN

(* 1 *)   IF LENGTH (SOURCE) <= 1 THEN
            EXIT (SCRAMBLE);

(* 2 *)   DESTINATION := '';

          REPEAT
(* 3 *)     SELECTEDCHAR := (RANDOM MOD LENGTH (SOURCE)) + 1;
(* 4 *)     DESTINATION  := CONCAT (DESTINATION,
                                    COPY (SOURCE, SELECTEDCHAR, 1));
(* 5 *)     DELETE (SOURCE, SELECTEDCHAR, 1);
(* 6 *)     UNTIL LENGTH (SOURCE) = 0;

(* 7 *)   SOURCE       := DESTINATION;

          END;    (* SCRAMBLE *)
```

Listing 4.

```
100  ONERR  GOTO 110
110  TEXT : HOME
120  POKE 768,1: POKE 769,0: POKE
     770,4: POKE 771,0: POKE 772,
     4: POKE 773,0
130  POKE 232,0: POKE 233,3
140  POKE  - 16368,0
150  ROT= 0
160  INPUT "STRING DESIGN # ?";A
170  POKE  - 16368,0
180  IF A < 0 THEN  END
190  SCALE= A
200  HGR2 : HCOLOR= 7
210  XDRAW 1 AT 140,95
220  FOR A = 1 TO 255
230  ROT= A: DRAW 1
240  IF  PEEK ( - 16384) = 141 THEN
     270
250  NEXT A
260  GOTO 220
270  POKE  - 16368,0: PRINT "";
280  IF  PEEK ( - 16384) < 128 THEN
     280
290  POKE  - 16368,0: GOTO 250
300  REM  BY DANIEL RICE
310  REM  "STRING ART"
]SAVHR#0
```

Big Letters – Small Letters

My Apple II now has the Keyboard Enhancer in place of the Paymar Adapter. As an enhancement to the basic Apple II, you still need software to make the lower-case characters appear in your text. With the Videoterm 80-column board, you have instant upper-lower case capability. And it works without special control characters. If you are also using the Z-80 Softcard, you can have the equivalent of two computers in the same case. You can do any of the regular Apple II things, or you can boot-up the CP/M disk and use the 80 column capability with the expanded capability of the Z-80 board. Next time, I'll give a more comprehensive review of the Videx Keyboard Enhancer. ☐

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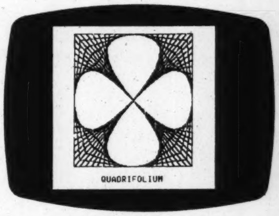

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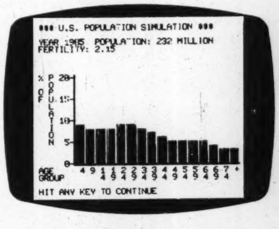
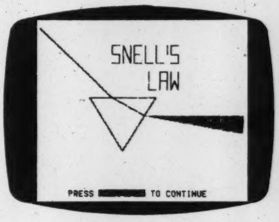


```
*** U.S. POPULATION SIMULATION ***
YEAR 1985  POPULATION: 232 MILLION
FERTILITY: 2.15
```

```
HIT ANY KEY TO CONTINUE
```

Disk CS-4708 Social and Economic Simulations
"Limits" is a microcomputer version of the well known "Limits to Growth" project done by the Club of Rome. It contains a model of a world that is built of five subsystems (population, pollution, food supply, industrial output, and resource usage) linked together by six variables: birth rate, death rate, pollution generation, resource usage rate, industrial output growth rate, and food production rate. "Market" allows two or more people to play the roles of companies who are competing for the market for a particular product. Each player makes marketing decisions quarterly including the production level, the advertising budget, and the unit price of the product for his company. "USPOP" allows the user to study many aspects of the United States' human demography (population change) including population growth, age and sex distribution. "USPOP" makes population projections and investigates the consequences of many different demographic changes. Requires 48K. Applesoft or Apple II Plus. $24.95. (Also available for PET/CBM and TRS-80.)



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PRESS ██████ TO CONTINUE
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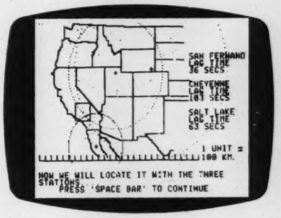

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NOW WE WILL LOCATE IT WITH THE THREE
STATIONS.
    PRESS 'SPACE BAR' TO CONTINUE
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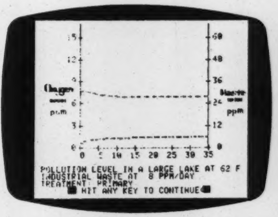

```
POLLUTION LEVEL IN A LARGE LAKE AT 62 F
INDUSTRIAL WASTE AT  8 PPM/DAY
TREATMENT: PRIMARY
    HIT ANY KEY TO CONTINUE
```

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Disk CS-4707 Ecology Simulations II
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DOMINOES

This month sees the final article in the present series on computer games, in which I have tried to cover a wide cross-section of games that require some measure of intellectual ability, and have attempted to include a number of general principles that might be of use in programming an even wider variety of games. In this month's article I shall describe how to write a program to play dominoes, using principles encountered earlier in the series.

At first sight, dominoes is not a particularly demanding game, but to play really well requires a combination of deep calculation and a certain measure of memory. In one respect the game is very similar to backgammon — luck plays a big part, but the skilled player can play with the odds and come out on top in a long series of encounters.

How to Play a Simple Version of Dominoes

A set of dominoes may be compared to a deck of cards, with 'suits' and 'denominations'. In most countries the domino set comprises 28 dominoes, each of which has two numbers painted on it. The numbers lie in the range 0 through 6, and no two dominoes have the same two numbers. Thus, the complete set comprises:

6-6	6-5	6-4	6-3	6-2	6-1	6-0
	5-5	5-4	5-3	5-2	5-1	5-0
		4-4	4-3	4-2	4-1	4-0
			3-3	3-2	3-1	3-0
				2-2	2-1	2-0
					1-1	1-0
						0-0

The concept of a suit is somewhat strange in dominoes: we may refer to all the dominoes containing a 6 as the 6-suit, but of course this suit will also contain a domino which may be found in the 5-suit, one which may be found in the 4-suit, etc.

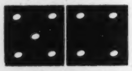
Countless games may be played with the set of dominoes. Here I shall describe a very simple game which I used to play as a child.

All dominoes are turned face down and shuffled, and each player picks seven dominoes at random, which he then looks at. The game may be played with two, three or four players, but I always found the game with two players was the most challenging and the most enjoyable. There is some method for deciding who goes first — this may be done by the toss of a coin, or it may alternate from one game to the next, or it can be the player who holds the highest double (in which case this double must be played on the first move). Once a domino has been placed on the table, face up, the players take it in turns to move.

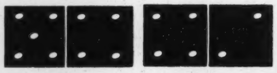
In order to make a move a player must put down a domino which has, as one of its numbers, the same number as one of the ends of the chain of dominoes already on the table. The new domino is put on the table in such a way that the matching parts of the two dominoes are next to each other. The other end of the new domino then forms a new end to the chain. Whenever a double domino is placed on the table it is put at right-angles to the end of the chain whose number matches the double. The following example illustrates the first few moves of a game.

Thus the game progresses, until the player whose turn it is to move cannot put a domino from his own hand at either end of the chain. He must then pick up dominoes from the shuffled set one at a time until he gets one which may legally be played at one end of the chain. The first player to get rid of all his dominoes wins the hand, and his opponent is debited by the number of points showing on all the dominoes remaining in his hand. It is customary

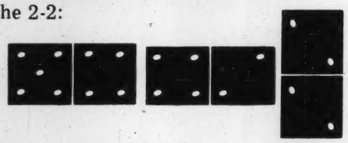
The first player (who won the toss) puts down the 5-4:



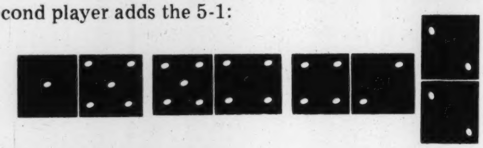
The second player puts the 4-2:



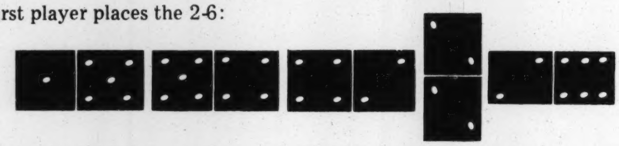
The first player puts the 2-2:



The second player adds the 5-1:



The first player places the 2-6:



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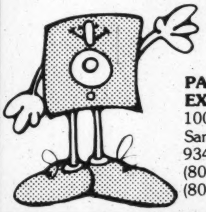

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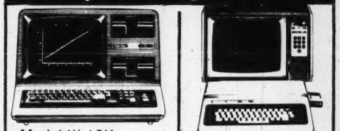

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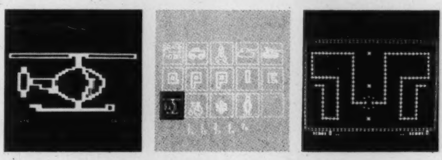

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to play until one player's total reaches a certain threshold, say 101, and he loses the game.

Playing Strategy

The game may conveniently be split up into two distinct phases and we shall briefly consider the second phase first. Once all the dominoes from the shuffled set have been taken into the players' hands, it is easy for the players to determine exactly which dominoes are held by his opponent. (Of course, in a three or four-handed game it is usually not possible to determine where the remaining dominoes lie until later in the game, when each player has only two or three dominoes left. Then it will usually be possible to deduce which players have which dominoes from a knowledge of which players 'passed', ie, indicated that they had no legal move.)

In a two-handed game, once you know which dominoes remain in your opponent's hand, it is relatively easy to search the game tree that includes every possible way in which the remaining dominoes can be played by each side. Since the average number of legal moves at the closing stage of the game is roughly two, the size of the whole of the game tree will be roughly 2^{14} terminal nodes, and so using the alpha-beta algorithm will enable the program to search this tree while examining only 100-200 terminal nodes. The evaluation function should reflect the method of scoring by assigning to each terminal node the number of pips on the remaining dominoes in the hand of the player who loses. Thus pips in the user's hand will be measured on the scale of positive integers, those in the computer's hand will be negative integers. Since your computer will be able to calculate and search the game tree more quickly and more accurately than human players, there is considerable scope for your program to defeat a human from a theoretically losing position, since the program will always play the endgame perfectly, whereas a human will cometimes miscalculate.

The program can increase its advantage in the endgame in certain situations where it has more than one move which will, with best play, lead to the same result. It can choose the move which, in some sense maximises the probability that its opponent will make a mistake. The simplest way to do this is to choose whichever move will lead to the best score if the user makes the smallest mistake possible during the remainder of the game. If the moves still appear to be of equal merit, assume that the user will make the second smallest mistake possible, and so on. This optimistic modification to the traditional method of searching the game tree is not dissimilar to Donald Michie's technique for assuming imperfect play on the part of the opponent, which was mentioned in an earlier article.

A more difficult problem to solve is how to decide what move to make in a pre-endgame situation, when the program does not know exactly which dominoes are held by its opponent. The strategy here is similar to the one employed in some of the card games discussed earlier. The program begins the game with the knowledge that each unseen domino has the same probability of being in the user's hand and then these probabilities are adjusted in the light of experience (ie, which dominoes are played by the user and in which situations the user is forced to take dominoes from the shuffled set). Let us see how this method works by examining the first few moves of a sample game. We shall assume that we are playing the version in which the player holding the highest double makes the first move.

The program is dealt the following seven dominoes:

6-4 6-1 5-3 5-0 3-3 3-0 2-1

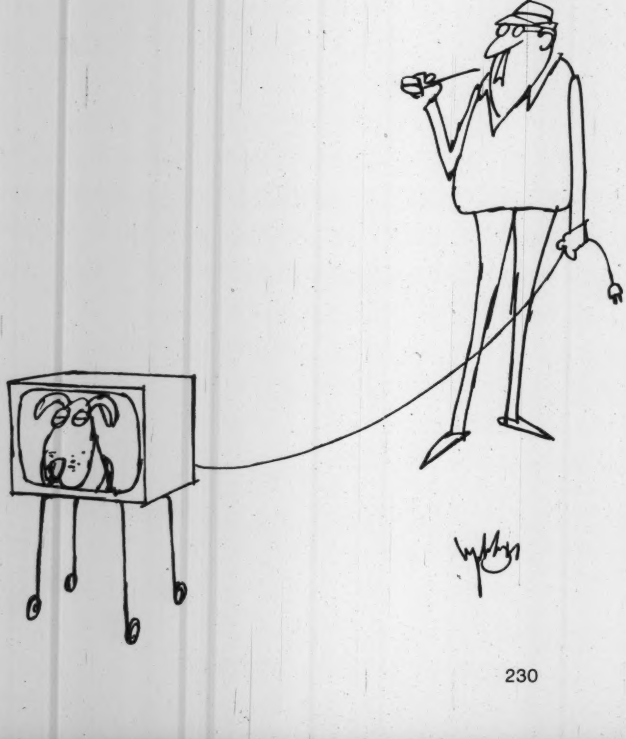
The user does not have the double 6, and so asks the program 'Do you have the 6-6?' When the program replies 'No', the user puts down the 5-5. Immediately the program assigns a probability of zero to the 6-6, since it is certain that the 6-6 is not in the user's hand, and all the remaining unseen dominoes have a probability of 0.3 (6/20), since the user now has six dominoes and there are 20 unseen dominoes, excluding the 6-6 which the program knows is not in the user's hand.

The program must now decide between playing the 5-3 and the 5-0, and it is here that we must employ some sort of evaluation function. What are the features that we should consider for such a function?

It is clear that one important aspect of dominoes lies in trying to prevent your opponent from putting down one of the dominoes in his hand, thereby forcing him to pick up from the shuffled set and putting off the time when he will have got rid of all his dominoes. So one feature must relate to the probability that the user will be able to put down a domino from his hand on the next turn. If the program now plays the 5-3, the user will have to play a 5 or a 3. The program can calculate the expected number of 5s and 3s in the user's hand simply by adding together the probabilities for the 5s and 3s. Similarly, the program can calculate the expected number of 5s and 0s (in case the program decides to play the 5-0). We shall call the expected number of moves by the opponent E.

Another important feature is the probability that after the user has moved the computer will have a legal move at its disposal and this feature should reflect the fact that the program would like to have as wide a choice as possible. This feature can also take advantage of the probabilities, albeit in a more complicated manner, as can be seen from the following discussion.

If the program plays a 5-3, the user has a number of theoretically feasible plays at his disposal. If we denote the dominoes assumed to be playable by D_a D_b D_c D_d. . . etc, and the probability of the user having each of these



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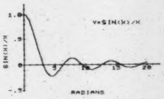

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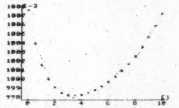

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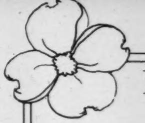

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dominoes in his hand is denoted by $P(D_a)$, $P(D_b)$, $P(D_c)$, $P(D_d)$ . . . etc, then by making the approximation that the user is equally likely to make any of the legal moves at his disposal, we can derive the following measure for the expected number of legal moves at the program's disposal after the user's next move if the program chooses 5-3 at this move:

$P(D_a) \times N_a + P(D_b) \times N_b + P(D_c) \times N_c + P(D_d) \times N_d + \ldots$ etc,

where N_a, N_b . . . etc, are the number of moves at the program's disposal should the user choose to play domino a, b . . . etc. (Note that in certain circumstances one domino can be played at either end of the chain, for example if the ends of the chain are a 6 and a 1, then the 6-1 domino can be played either way round. Each of these plays should be counted as a separate play for the purpose of counting the values of the N_a, N_b . . . etc.) We shall call this expected number of legal moves for the program EP.

One other feature which is useful to take into consideration is the number of pips on each of the dominoes that the program can play in a given situation. Since the losing player in a hand is penalised to the extent of the pips on his remaining dominoes, it is obviously a useful generalisation to play the domino with the highest pip count, all other factors being equal. But since this heuristic would result in very predictable play on the part of the program, in a way which an intelligent human opponent could use to his advantage, it would be wise to vary the play of the computer slightly by ensuring that a measure of randomness was used in the decision-making process. I would suggest that when the computer was ahead in the hand, ie, when the user had picked up more dominoes from the shuffled set than had the computer, then weighting for this pip feature should be small, so that the program might play less predictably. When the program was doing badly, the weighting for this feature should be relatively large, so that if the user won the hand (as might seem likely) the program's loss on that hand would be minimised. When neither side seemed to have any advantage in a hand, the weighting should be somewhere between the two. We shall call the number of pips played PP.

Our evaluation function now looks like this:

(W_1 x opponent's expected number of legal moves) + (W_2 x computer's expected number of legal replies) + (W_3 x number of pips played on this move) or, more symbolically:

$W_1 \times E + W_2 \times EP + W_3 \times PP$

Adjusting the Probability Table

After each play by the user it will be necessary to adjust the table of probabilities for all the remaining unseen dominoes. Obviously we gain the greatest amount of information when the user cannot make a move without picking up from the shuffled set, because at that time we know that he does not hold any of the dominoes which can legally be played. We therefore set the probability for each of these legal dominoes to zero, and normalise the probabilities for the remaining dominoes. We also learn a certain amount when the user actually plays a domino — he no longer has any likelihood of holding that domino in his hand since it is now on the table, so its probability is set to zero and again the remaining probabilities are normalised. In addition to these rather obvious situations, there are other occasions when the program can derive useful information from the user's choice of which domino to play.

Let us assume, for example, that the ends of the chain show a 3 and a 1, and that the program has previously shown itself to be out of 1s (having picked up from the shuffled set at a time when both ends of the chain showed a 1). Then, if the user does not play the 3-1 on the 3, which would be sure to deprive the program of a move and compel it to pick up dominoes ad nauseam, then it is safe to assume that the user does not hold the 3-1 (unless he is an idiot). The probability for the 3-1 can therefore be set at zero and the remaining probabilities normalised. When considering such situations, the program should ensure that a play such as the 3-1 will not deprive the user of any legal moves, unless the user would then have many fewer dominoes than the program, in which case, with neither side being able to move, the computer would lose the hand.

For those readers who feel that the strategy described so far is lacking in real sophistication, there is one further refinement which would make the program outstandingly strong, but for the move execution time to be realistic your program would need to be written in assembler language. When the user has made a move, if the program has a choice of reply it should perform the following calculations.

For each and every possible combination of dominoes in its opponent's hand (of which there will never be more than about 39,000), the program should compute the scores which it will assign to each of the user's legal moves, and convert these scores into probabilities, by normalising them. It will then have, for each possible user holding, the probability with which each move would be made. The program then looks at the move actually made by the user, and uses Baysian probability to determine the probability that the move actually came from each of the possible holdings. Finally, knowing the probability that the user actually holds each of the possible holdings, the program can calculate a much more accurate estimate for the user holding each of the unseen dominoes that could be in his hand. This series of calculations can be done when the user makes his first free choice of play (ie, ignoring situations in which the user moves first), and can retain this information throughout the hand. After the user's second free choice move, the program can combine the results of the two sets of calculations by determining the mean probability for each card from the two calculations. The third time the program would weight the old and new calculations in the ratio of 2:1, to take into account the fact that the old calculations were made on the basis of two moves, while the new ones were made solely on the basis of the last move. The fourth time would see weightings of 3:1 and so on. This level of sophistication would probably produce a program of World Championship calibre!

Bibliography

Many books provide descriptions of different variants on the game of dominoes. For the serious student I would recommend: Armanino, Dominic C: *Dominoes: Popular Games, Rules & Strategy*, Cornerstone Library, New York, 1977. This book describes the game of 'Five-Up' which is extremely popular in the USA, and it provides material for playing heuristics which can be used in an evaluation function.

In closing the present series of articles I would like to say how much I have enjoyed writing them and I would like to thank the publishers of this magazine for enabling me to enthuse readers with an interest in computer games. I very much hope that many of you have been busily writing your own programs to play games on your personal computers, and that you have had and will have many enjoyable hours of play with your electronic opponent. In the future I shall write occasional articles, whenever I find something to interest you in the field of computer games. ☐

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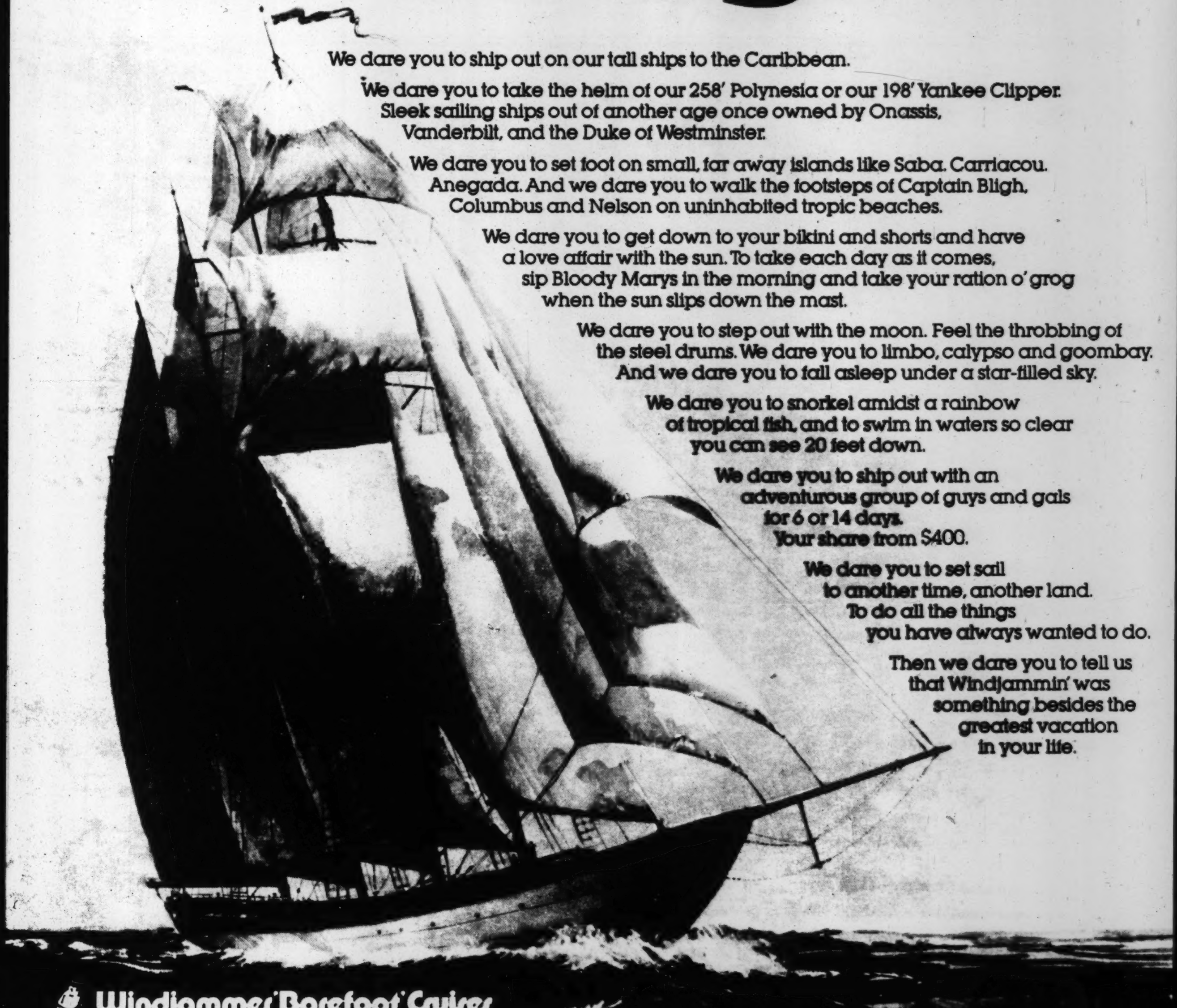

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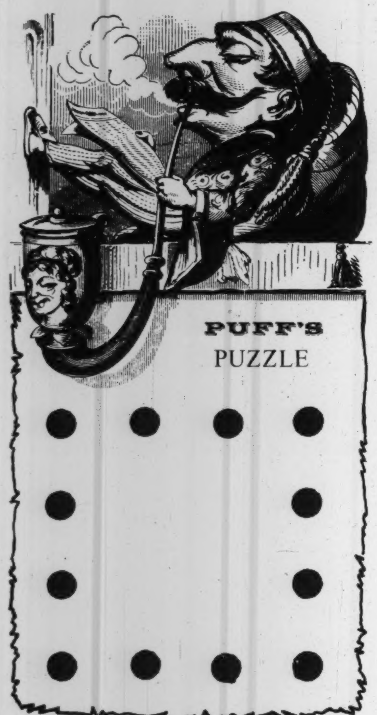
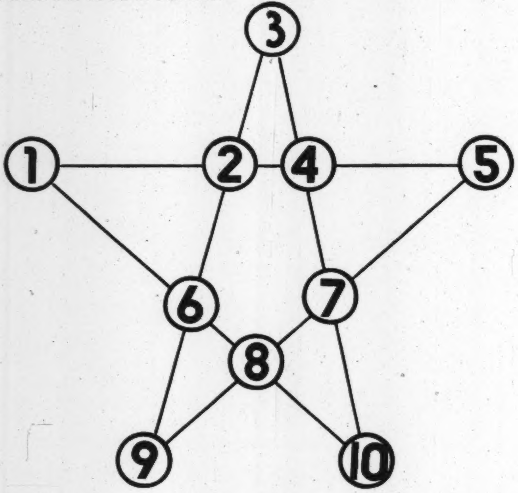


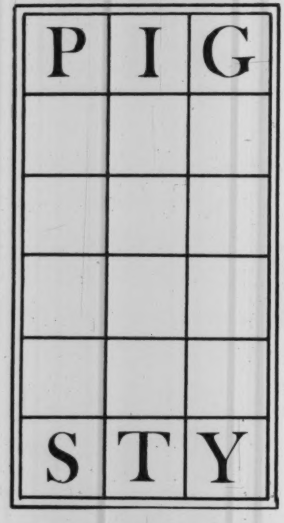
Mr. Puff's Puzzle

Mr. Puff has an interesting little puzzle for us. Lay out twelve coins in the form of a square, four coins to a side. Now rearrange the twelve coins so that there are five coins on each side of the square. (Editor's note: Please don't ask me who Mr. Puff is. When I arrived in the morning, there was a note on my desk, "Use this puzzle". I think he's one of Merlin's relatives.) (From the book *Merlin's Puzzler 2* by Charles Barry Townsend, published by Hammond, Inc.)

A "Star" Attraction

Here's a solitaire puzzle Merlin showed me with coins the other day. Using the diagram pictured below place a coin on each numbered circle in the star except number 8. Now, just as you would in checkers, jump one coin over another along one of the straight lines to an empty circle beyond. Remove the coin you jumped over from the board. The object is to end up with just one coin left on the board. Remember, you can only jump coins over one another, you cannot *move* coins from one circle to another.





The Pig To Sty Puzzle

It's time for a change-the-word puzzle. In our problem you have to change the word *PIG* into the word *STY* in 5 moves. (During each move the puzzler must change one letter in the previous word so that a new word is formed.)

The Misplaced Decimal

Here's a quick puzzle from Mr. John Mann, of Liverpool, New York. Mr. Mann writes:

"The decimal point in a decimal numeral was mistaken for a multiplication sign, thereby increasing the number which the numeral was intended to represent by 13.7. What was the numeral?"

Mr. Mann will receive one of Merlin's puzzle books for his contribution.

A Problem In Acreage

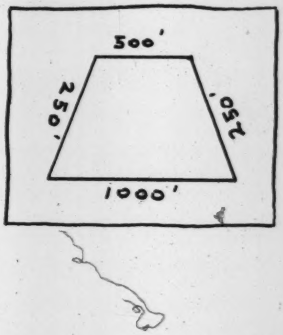
Slippery Sidney, a dealer in underwater acreage, is trying to close a fast deal on a piece of sight-unseen land.

"You'll love this lot," he said. "It has a beautiful view of the ocean. And, it will only cost you $25,000 for all these acres of shore front property."

"That's what I want to know", replied Gullible George. "Just how many acres of land am I getting for my money. Let me see that map again. First I have to figure out how many square feet of land is in the lot, and then I'll have to divide this amount into the number of square feet in an acre. By the way Sidney, how many square feet are there in an acre?"

"Well, ahem, there are 43,560 square feet in an acre, but why bother figuring it out. Take my word for it, you're going to make out like a bandit on this deal."

Do you think George is getting a "square deal" or a "raw deal" from Sidney? Check the map of the lot below and see just how many acres he would get for his money.



A Simple Substitution

As it stands the subtraction pictured at right is false. If however, you substitute a number (0 through 9) for each letter you can come up with several correct solutions. The same number must be used for like letters. Your problem is to find the solution that allows each letter to have the highest value possible.

```
 FOUR
-TWO
-----
  TEN
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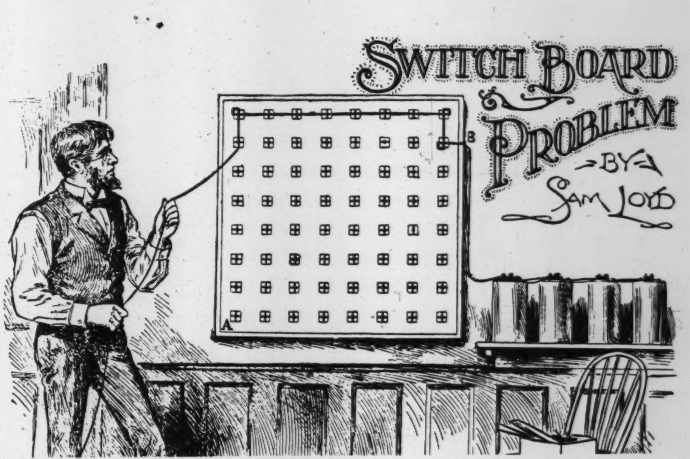
The following puzzle, circa 1900, is from the dean of American puzzle inventors, Sam Loyd. See if you can find a solution shorter than the one Mr. Loyd gives us.

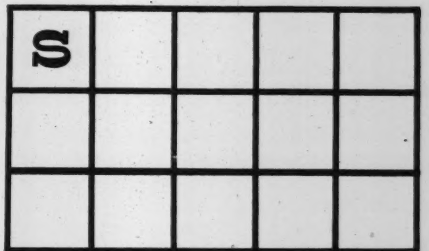


"To show how good puzzle ideas may be picked up from time to time "as we journey by the way," I will give a little problem that I was called upon to tackle the other day. I found an electrician, who had invented some kind of switchboard, trying to work out the most economical method of stringing a fine copper wire through all the contact points on his board. The board was an elaborate affair, consisting of several hundred points, but since 64 is sufficient to illustrate our problem, only an eight-by-eight section of the board is shown above."

"The problem is to find the shortest length of wire that will go from point *B* to the center of the little square marked *A*. The wire must touch the centers of all 64 little squares. Each square is one inch wide, and they are paced so their centers are three inches apart. Each time a wire turns a corner, it is necessary to wind it around a corner of the square, an operation that used two inches of wire. No diagonal connections are permitted."

"Assuming that two inches of wire are used in going from *B* to the center of the nearest little square, can you determine the shortest length of wire required to go from *B* to *A*?"

The Touring Knight



Our last problem presents the puzzler with a pretty and perplexing problem pertaining to perambulating pieces. Make up a facsimile of the 20-square gameboard shown here. Place a chess knight in the upper left-hand square (the one marked *S*). The object is to move the knight from square *S* to square *F*. You can only use knight's moves. The knight must land within every square on the board. Each square must be landed on only once. The last move must find the knight sitting in square *F*. (This puzzle is from the book *Merlin's Puzzler* by Charles Barry Townsend and published by Hammond, Inc.)

Answers on page 256.

I hope you have enjoyed this month's problems. Keep the puzzles coming in. Remember, if Merlin uses your puzzle he will send you one of his famous books. Until next month,

Your editor,

Charles Barry Townsend

m...software legal forum...s

Barry D. Bayer

It has been brought to my attention by the regular proprietor of this space, that the first part of this series on Contract Law and Personal Computers assumes that the sale of a computer program is a sale of personal property which is governed by Article 2 of the Uniform Commercial Code ("UCC") with respect to the Sale of Goods. "Where," I was asked "was your authority that a program is 'goods'?" As I must plead guilty to this charge of 'assuming' without clearly stating my assumptions, (if not of the greater sin of inadequate analysis of the problem), I must preface Part 2 of these remarks with the consideration of a most confusing legal question which, to my knowledge, has not been answered in any reported Court opinion:

"Is a mass marketed computer program 'goods' or a 'service'?"

The really nice thing about the Uniform Commercial Code is that it was designed to be a fully integrated embodiment of the law, complete with large numbers of definitions. (That is not to say that the UCC is always clear. More than 30 1500+ page volumes of a series called the UCC Reporter Service recording court decisions interpreting the UCC in courts throughout the country since it was first adopted in Pennsylvania in 1953, tend to indicate the contrary.) But the first thing to do when using the UCC is always to check for any applicable definitions. Section 2-103 (in the beginning of Article 2) states:

"Unless the context otherwise requires, this Article applies to transactions in goods; . . ."

"Goods," we are told in Section 2-105

"means all things (including specially manufactured goods) which are movable at the time of identification to the contract for sale other than the money in which the price is to be paid, investment securities (Article 8) and things in action."

Now one of the other nice things about the UCC is that Official Comments appear after each section of the Code. If a definition, or any other part of the law is unclear, we can go to the "Official Comment" for that section and learn what the authors of the Code intended the section to mean. (Unfortunately, these "Official Comments" are not "Official" in the sense that they were adopted by the state legislature as part of the Code. Nonetheless, they provide a useful guide.) Unfortunately, the Official Comments to Section 2-105 provide us with little learning applicable to our problem.

Interestingly, the term "transaction" is not defined, but Section 1-201(11), in the "global" definition section applicable to the entire UCC, defines "contract" to be

" . . . the total legal obligation which results from the parties' agreement as affect by this Act and any other rules of law. (Compare 'Agreement.')"

"Agreement," Section 1-201(3) tells us

"means the bargain of the parties in fact as found in their language or by implication from other circumstances including course of dealing or usage of trade or course of performance as provided in this Act (Sections 1-205 and 2-208). Whether an agreement has legal consequences is determined by the provisions of this Act, if applicable; otherwise by the law of contracts (Section 1-103). (Compare 'Contract.')"

Finally, Section 2-106(1) gives a definition applicable only to Article 2 (sort of like a locally defined variable) which states in part

"In this Article unless the context otherwise requires 'contract' and 'agreement' are limited to those relating to the present or future sale of goods."

So we know that Article 2 governs the sales of goods, but this doesn't really help us much, and the balance of the text of the UCC, itself (and Comments) doesn't really help any further.

As an important step in analyzing legal problems, lawyers attempt to find reported decisions by judges who have encountered similar problems. Taking a look at cases involving computer programs and the UCC, we find only a couple of situations, all involving not "computer programs" but "programming of computers."

In a very real sense this is the difference between what computers used to be—the large main frames—and what computers are today (or will be soon)—mass market (or personal, if you like) computing. In "the old days," you bought or rented a computer, one of hundreds, or maybe thousands of a particular model. Sometimes software came with the machine. More often software had to be purchased. And even more often computer programmers had to be purchased (in house staff) or rented (consultant and free lance programmers). Even when more or less off-the-shelf software was purchased it was probably "licensed" rather than "sold." The software supplier often sent representatives to install and customize the program for each customer's particular configuration and particular uses. Such representatives also assisted in bringing the application on line. These programs might have cost thousands or tens of thousands of dollars, and probably included required additional monthly or annual fees for "maintenance."

Contrast the "good old days" with the present world of the microcomputer. Machines are measured by the hundreds of thousands, and software is procured not through a custom programming firm, but purchased from local computer stores, or ordered through the mail. This is similar to buying a book. True, a couple of software organizations do offer "update service"; and many make efforts to answer user questions about their software. Also, some software is purportedly sold by means of license agreements; and it is also true that it is what the program *does* that makes it valuable rather than the tangible disk and

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Dodgem is one of nine games in the **Apple Games Pac**, a collection of strategy and action games. Other games on the disk include **Nuclear Reaction** (a challenging high-tech version of Roman checkers), **Brickout** (knock down a wall—four skill levels), **Blockade** (two players each build a trail of walls), **Torpedo Alley** (destroy enemy ships with torpedoes from your submarine), **StarWars** (zap the TIE fighters—a joystick helps!), **Rocket Pilot** (land in rough terrain), **Saucer Invasion** (your SAM missiles against the devious saucers) and **Genius** (a fast-paced, timed trivia quiz).

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CIRCLE 166 ON READER SERVICE CARD

Legal Forum, continued...

manual. But it seems to me that the purchase of software for microcomputers these days is more a purchase of a "movable thing" than the purchase of a "service." (Each reader is, of course, entitled to render his or her own opinion about this question. Ultimately some court will probably have to make such a determination, and then we will know what the answer is, unless of course, some other court renders a different decision.)

Sometimes the easiest way of learning about an area of the law is to search the "Law Reviews"—respected journals of legal analysis and opinion published by law schools, and usually edited by law students. In 1979 The University of Michigan Law Review published a short article, (Volume 77, Page 1149), written by a student, entitled "Computer Programs as Goods Under the U.C.C." The author begins the article with the statement that "Computer programs frustrate the law's traditional categories: they exhibit characteristics of both concrete property and abstract knowledge." It concludes with the thought that if UCC Article 2 does not apply to computer programs, it should; but if a Court should find that Article 2 did not apply, it would likely use the concepts of Article 2 by analogy in analyzing the situation.

And that's really a pretty good thought. Let us assume, for a moment, that Article 2 does not apply. Let us assume that as I visit my computer store, and walk out with Applewriter, I am purchasing a service, rather than goods. Article 2 would not be applicable, and we would be left to non-Uniform contract law regarding the sale and purchase of services. But courts often like the structure and scheme of the UCC. They sometimes find that Contract rules as brought together in the Code make a great deal of common sense. For that reason, courts have often held with respect to transactions in real estate (not movable), automobile rental (not a sale) and the like, that although not controlled by Article 2, its provisions would be used as a guide. Should a seller's warranty obligations under the UCC be substantially different than a lessor of the same item under a long term lease? Even if a house is not goods, shouldn't a home builder be required to build a home without an immediate roof leak? In other words, even if Article 2 doesn't apply to a software transaction, because supplying of software is the supplying of a service, it is likely that a judge considering a difficult software warranty problem, would draw on the Article 2 warranty provisions in making his decision.

Finally, if I erred in assuming that Article 2 applied to the sale of microcomputer software, it is obvious from reading the warranty disclaimers that come with so many of these programs, that I have a lot of company. Most of these documents can only be understood in the context of the UCC. For that reason, alone, a little bit of learning about the UCC might come in handy some day.

One other confession. My discussion thus far, has assumed that the obligations and rights of the Seller and the Manufacturer are the same. This is not necessarily so, and some of the differences will be discussed in a later column. In the meantime, please keep in mind that it is quite possible that a Seller may be liable to you, and not the software Publisher, or vice versa.

After the above long introduction, you may recall that we were discussing, in the November "Software Legal Forum," a situation in which a product (it could be a program, hardware, or even a ROM which is both program and hardware) was sold with a long document called a warranty. Actually the document should be called a disclaimer of warranty. In that piece of paper the Seller told the buyer that neither he, the manufacturer, or anyone else in the distribution chain would be liable for anything, whether or not the product failed to work in 30 days, or even never worked at all. I won't bother to reprint the language here because you've probably seen these things on 90 percent of the equipment and programs that you own, but let's give it a rough outline.

First of all, the Seller says that he makes no warranties, either express (specific promises, advertising claims, models, and the like) or implied (warranties of merchantability and fitness for a particular purpose). To back this up, the Seller continues that the goods (services?) are sold "as-is." "As-is" is really another way of saying "no warranties."

Second, the Seller tells you that any risk that the program works well, or works at all belongs to you, and not to the Seller. You, and not the Seller, will have to fix it if something goes wrong (or is wrong from the beginning.)

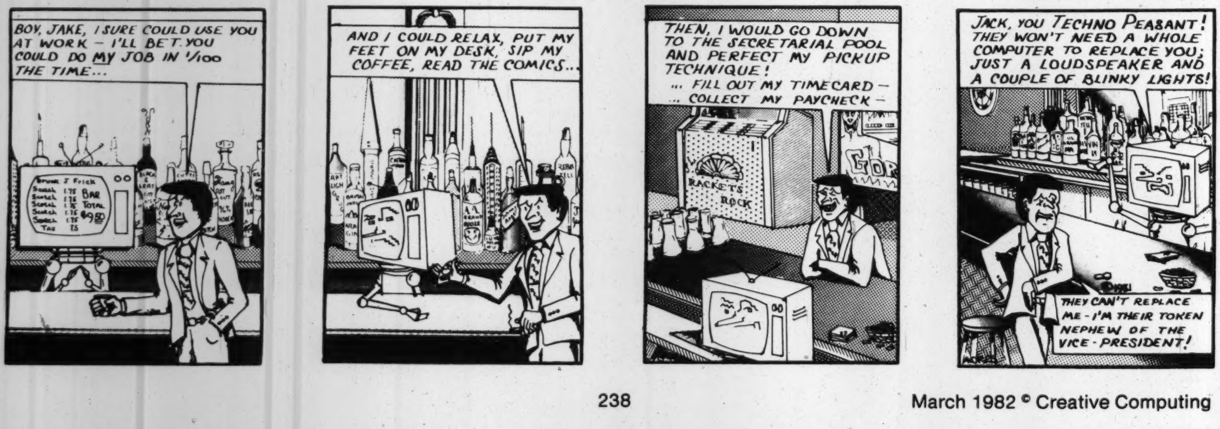
Next, the Seller discusses damages. He attempts to make you responsible for damages which are direct, indirect, incidental or consequential. Direct damages are usually measured by the cost of the product and perhaps the cost of repair. Consequential damages are the damages that you incur because of the defect. In a software context, the loss from uncollected accounts receivable due to a bug destroying your files (and perhaps the cost of reconstructing those files) might be considered consequential damages. Incidental damages might include phone calls made to ascertain the difficulty, shipping charges in trying to get a new part, and the cost of aspirin taken to alleviate the headaches occurring when dealing with the defect. However, in all cases, the UCC requires the Buyer to "cover." Cover means that the Buyer must try to purchase a replacement product so as to minimize his or her losses.

Finally, the last sentence of the "Warranty" states that all of this might not apply to the particular transaction, because your state legislature might have decided not to permit such broad disclaimers. This is a nice thought, which is required by Federal law. Unfortunately, you will probably find that *your* state legislature hasn't found these disclaimers particularly evil, and has not outlawed them.

In the next discussion of Buyer's rights, I will discuss the legal and practical effects of a breach of the Seller's warranty. ☐

Bit Pit

Chas Andres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AND I COULD RELAX, PUT MY FEET ON MY DESK, SIP MY COFFEE, READ THE COMICS...
THEN, I WOULD GO DOWN TO THE SECRETARIAL POOL AND PERFECT MY PICKUP TECHNIQUE! ... FILL OUT MY TIMECARD – ... COLLECT MY PAYCHECK –
RACKETS ROCK
JACK, YOU TECHNO PEASANT! THEY WON'T NEED A WHOLE COMPUTER TO REPLACE YOU; JUST A LOUDSPEAKER AND A COUPLE OF BLINKY LIGHTS!
THEY CAN'T REPLACE ME – I'M THEIR TOKEN NEPHEW OF THE VICE-PRESIDENT!

The Best Boards
SD Prices Slashed !!!

Single User System

SBC-200, 64K ExpandoRAM II, Versafloppy II, CP/M 2.2

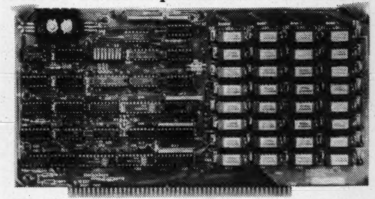
$995.00

4 MHz Z-80A CPU, 64K RAM, serial I/O port, parallel I/O port, double-density disk controller, CP/M 2.2 disk and manuals, system monitor, control and diagnostic software.

-All boards are assembled and tested-

ExpandoRAM III

64K to 256K expandable RAM board



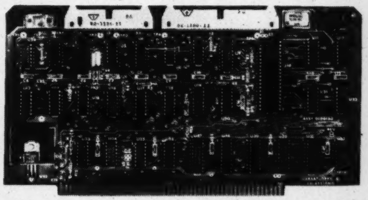
SD Systems has duplicated the famous reliability of their ExpandoRAM I and II boards in the new ExpandoRAM III, a board capable of containing 256K of high speed RAM. Utilizing the new 64K x 1 dymanic RAM chips, you can configure a memory of 64K, 128K, 192K, or 256K, all on one S-100 board. Memory address decoding is done by a programmed bipolar ROM so that the memory map may be dip-switch configured to work with either COSMOS/MPM-type systems or with OASIS-type systems.

Extensive application notes concerning how to operate the ExpandoRAM III with Cromemco, Intersystems, and other popular 4 MHz Z-80 systems are contained in the manual.

MEM-65064A	*64K A & T*	**$495.00**
MEM-65128A	*128K A & T*	**$639.95**
MEM-65192A	*192K A & T*	**$769.95**
MEM-65256A	*256K A & T*	**$879.95**

Versafloppy II

Double density controller with CP/M 2.2



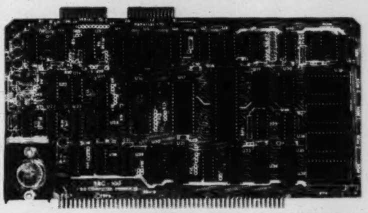
- S-100 bus compatible • IBM 3740 compatible soft sectored format • Controls single and double-sided drives, single or double density, 5¼" and 8" drives in any combination of four simultaneously • Drive select and side select circuitry • Analog phase-locked loop data seperator • Vectored interrupt operation optional • CP/M 2.2 disk and manual set included • Control/diagnostic software PROM included

The Versafloppy II is faster, more stable and more tolerant of bit shift and "jitter" than most controllers. CP/M 2.2 and all necessary control and diagnostic software are included.

IOD-1160A *A & T with CP/M 2.2* .. **$370.00**

SBC-200

2 or 4 MHz single board computer



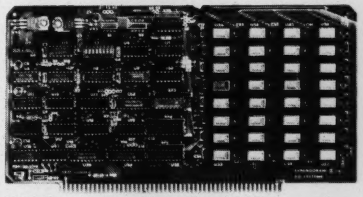
- S-100 bus compatible • Powerful 4MHz Z-80A CPU • Synchronous/asynchronous serial I/O port with RS-232 interface and software programmable baud rates up to 9600 baud • Parallel input and parallel output port • Four channel counter/timer • Four maskable, vectored interrupt inputs and a non-maskable interrupt • 1K of on-board RAM • Up to 32K of on-board ROM • System monitor PROM included

The SBC-200 is an excellent CPU board to base a microcomputer system around. With on-board RAM, ROM, and I/O, the SBC-200 allows you to build a powerful three-board system that has the same features found in most five-board microcomputers. The SBC-200 is compatible with both single-user and multi-user systems.

CPU-30200A *A & T with monitor* **$299.95**

ExpandoRAM II

16K to 64K expandable RAM board



- S-100 bus compatible • Up to 4MHz operation • Expandable from 16K to 64K • Uses 16 x 1 4116 memory chips • Page mode operation allows up to 8 memory boards on the bus • Phantom output disable • Invisible on-board refresh

The ExpandoRAM II is compatible with most S-100 CPUs. When other SD System' series II boards are combined with the ExpandoRAM II, they create a microcomputer system with exceptional capabilities and features.

MEM-16630A	*16K A & T*	**$325.00**
MEM-32631A	*32K A & T*	**$345.00**
MEM-48632A	*48K A & T*	**$365.00**
MEM-64633A	*64K A & T*	**$385.00**

COSMOS

Multi-user operating system

- Multi-user disk operating system • Allows up to 8 users to run independent jobs concurrently • Each user has a seperate file directory

COMOS supports all the file structures of CP/M 2.2, and is compatible at the applications program level with CP/M 2.2, so that most programs written to run under CP/M 2.2 or SDOS will also run under COSMOS.

SFC-55009039F *COSMOS on 8" disk* **$395.00**

Multi-User System

SBC-200, 256K ExpandoRAM III, Versafloppy II, MPC-4
COSMOS Multi-User Operating System, C BASIC II

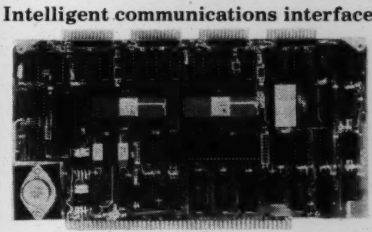
$1995.00

Two Z-80A CPUs (4 MHz), 256K RAM, 5 serial I/O ports with independently programmable baud rates and vectored interrupts, parallel input port, parallel output port, 8 counter/timer channels, real time clock, single and double sided/single or double density disk controller for 5¼" and 8" drives, up to 36K of on-board ROM, CP/M 2.2 compatible COSMOS interrupt driven multi-user disk operating system, allows up to 8 users to run independent jobs concurrently, C BASIC II, control and diagnostic software in PROM included.

-All boards are assembled and tested-

MPC-4

Intelligent communications interface



- Four buffered serial I/O ports • On-board Z-80A processor • Four CTC channels • Independently programmable baud rates • Vectored interrupt capability • Up to 4K of on-board PROM • Up to 2K of on-board RAM • On-board firmware

This is not just another four-port serial I/O board! The on-board processor and firmware provide sufficient intelligence to allow the MPC-4 to handle time consuming I/O tasks, rather than loading down your CPU. To increase overall efficiency, each serial channel has an 80 character input buffer and a 128 character output buffer. The on-board firmware can be modified to make the board SDLC or BISYNC compatible. In combination with SD's COSMOS operating system (which is included with the MPC-4), this board makes a perfect building block for a multi-user system.

IOI-1504A *A & T with COSMOS* .. **$495.00**

Place Orders Toll Free

Continental U.S.	*Inside California*
800-421-5500	**800-262-1710**

For Technical Inquires or Customer Service call:
213-973-7707

JADE
Computer Products

4901 W. Rosecrans, Hawthorne, Ca 90250

TERMS of SALE: Cash, checks, credit cards, or Purchase Orders from qualified firms and institutions. **Minimum Order $15.00.** California residents add 6% tax. Minimum shipping & handling charge $3.00. **Pricing & availibility subject to change**

CIRCLE 199 ON READER SERVICE CARD

JADE
Computer Products

Printers

BETTER THAN EPSON ! - Okidata

Microline 82A *80/132 column,* ***120 CPS****, 9 x 9 dot matrix, friction feed, pin feed, adjustable tractor feed (removable), handles 4 part forms up to 9.5" wide, rear & bottom feed, paper tear bar, 100% duty cycle/200,000,000 character print head, bi-directional/logic seeking, both serial & parallel interfaces included, front panel switch & program control of 10 different form lengths, uses inexpensive spool type ribbons, double width & condensed characters, true lower case descenders & graphics*

PRM-43082	*with FREE tractor*	**$539.95**

Microline 83A *132/232 column, 120 CPS, handles forms up to 15" wide, plus all the features of the 82A.*

PRM-43083	*with FREE tractor*	**$749.95**

PRA-27081A	*Apple card*	**$39.95**
PRA-27082A	*Apple cable*	**$19.95**
PRA-27087A	*TRS-80 cable*	**$24.95**
PRA-43080	*Extra ribbons pkg. of 2* ...	**$9.95**

INEXPENSIVE PRINTERS - Epson

MX-70 *80 column, 80 CPS, 5 x 7 dot matrix, adjustable tractor feed, & graphics*

PRM-27070	*List $459*	**$399.95**

MX-80 *80 column, 80 CPS, bi-directional/logic seeking printing, 9 x 9 dot matrix, adjustable tractor feed, & 64 graphics characters*

PRM-27080	*List $645*	**$469.95**

MX-80FT *same as MX-80 with friction feed added.*

PRM-27082	*List $745*	**$559.95**

MX-100 *132 column, correspondence quality, graphics, up to 15" paper, friction feed & adjustable tractor feed, 9 x 9 dot matrix, 80 CPS.*

PRM-27100	*List $945*	**$759.95**

PRA-27084	*Serial interface*	**$69.95**
PRA-27088	*Serial intf & 2K buffer* ..	**$144.95**
PRA-27081	*Apple card*	**$74.95**
PRA-27082	*Apple cable*	**$22.95**
PRA-27086	*IEEE 488 card*	**$52.95**
PRA-27087	*TRS-80 cable*	**$32.95**
PRA-27085	*Graftrax II*	**$95.00**
PRA-27083	*Extra ribbon*	**$14.95**

NEC 7700 & 3500

NEC Spinwriter w/Intelligent Controller

Standard serial, Centronics parallel, and current loop interfaces • Selectable baud rates 50 to 19,200 • Automatic bidirectional printing • Logic seeking • 650 character buffer with optional 16K buffer • 55 characters per second print speed • Comes with vertical forms tractor, ribbon, thimble and cable • Diablo compatible software • Available with or without optional front panel

PRD-55511	*1K no front panel*	**$2795.00**
PRD-55512	*16K no front panel* ..	**$2895.00**
PRD-55515	*1K w/front panel*	**$2995.00**
PRD-55516	*16K w/front panel* ...	**$3095.00**

Intersell NEC 3500Q

New from NEC - the 3500 series Spinwriters. Incorporates all the features and reliability of the 5500 and 7700 series Spinwriters into an inexpensive 30 CPS letter quality printer with an optional bi-directional tractor assembly.

PRD-55351	*3500Q 1K*	**$1995.00**
PRD-55352	*3500Q 16K*	**$2095.00**
PRA-55100	*Deluxe tractor option* ..	**$300.00**

Accessories for Apple

16K MEMORY UPGRADE

Add 16K of RAM to your TRS-80, Apple, or Exidy in just minutes. We've sold thousands of these 16K RAM upgrades which include the appropriate memory chips (as specified by the manufacturer), all necessary jumper blocks, fool-proof instructions, and our 1 year guarantee.

MEX-16100K	*TRS-80 kit*	**$25.00**
MEX-16101K	*Apple kit*	**$25.00**
MEX-16102K	*Exidy kit*	**$25.00**

16K RAM CARD - for Apple II

Expand your Apple to 64K, 1 year warranty

MEX-16500A	*Save $70.00 !!!*	**$129.95**

Z-80* CARD for APPLE

Two computers in one, Z-80 & 6502, more than doubles the power & potential of your Apple, includes Z-80 CPU card, CP/M 2.2, & BASIC-80*

CPX-30800A	*A & T*	**$299.95**

8" DISK CONTROLLER

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CPM 2.2, Shugart & Qume compatible

IOD-2700A	*A & T*	**$499.95**

2 MEGABYTES for Apple II

Complete package includes: Two 8" double-density disk drives, Vista double-density 8" disk controller, cabinet, power supply, & cables, DOS 3.2/3.3, CP/M 2.2, & Pascal compatible.

1 MegaByte Package	*(Kit)*	**$1495.00**
1 MegaByte Package	*(A & T)*	**$1695.00**
2 MegaByte Package	*(Kit)*	**$1795.00**
2 MegaByte Package	*(A & T)*	**$19.95**

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock/calendar, serial interface, & parallel interface - all on one card.

IOX-2300A	*A & T*	**$199.95**

AIO, ASIO, APIO - S.S.M.

Parallel & serial interface for your Apple (see Byte pg 11)

IOI-2050K	*Par & Ser kit*	**$139.95**
IOI-2050A	*Par & Ser A & T*	**$169.95**
IOI-2052K	*Serial kit*	**$89.95**
IOI-2052A	*Serial A & T*	**$99.95**
IOI-2054K	*Parallel kit*	**$69.95**
IOI-2054A	*Parallel A & T*	**$89.95**

A488 - S.S.M.

IEEE 488 controller, uses simple basic commands, includes firmware and cable, 1 year guarantee, (see April Byte pg 11)

IOX-7488A	*A & T*	**$399.95**

Modems

CAT MODEMS - Novation

CAT *300 baud, acoustic, answer/orginate*

IOM-5200A	*List $189.95*	**$149.95**

D-CAT *300 baud direct connect, answer/orginate*

IOM-5201A	*List $199.95*	**$169.95**

AUTO-CAT *Auto answer/orginate, direct connect*

IOM-5230A	*List $299.95*	**$239.95**

Apple-CAT - Novation

Software selectable 1200 or 300 baud, direct connect, auto-answer auto-dial, auxiliary 3-wire RS232C serial port for printer.

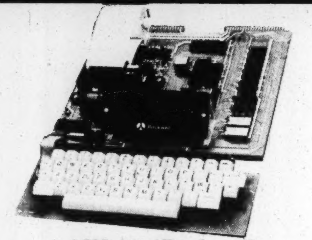
IOM-5232A	*Save $50.00!!!*	**$325.00**

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing, RS-232C interface, programmable

IOM-5400A	*Smartmodem*	**$269.95**

Single Board Computer



AIM-65 - Rockwell

6502 computer with alphanumeric display, printer, & keyboard, and complete instructional manuals

CPK-50165	*1K AIM*	**$424.95**
CPK-50465	*4K AIM*	**$474.95**
SFK-74600008E	*8K BASIC ROM* ..	**$64.95**
SFK-64600004E	*4K assembler ROM*	**$43.95**
PSX-030A	*Power supply*	**$64.95**
ENX-000002	*Enclosure*	**$54.95**

4K AIM, 8K BASIC, power supply, & enclosure

Special package price	....	**$649.95**

Z-80 STARTER KIT - SD Systems

Complete Z-80 microcomputer with RAM, ROM, I/O, keyboard, display, kludge area, manual, & workbook

CPS-30100K	*KIT*	**$299.95**
CPS-30100A	*A & T*	**$469.95**

SYM-1 - Synertek Systems

Single board computer with 1K of RAM, 4K of ROM, key-pad, LED display, 20ma & cassette interface on board.

CPK-50020A	*A & T*	**$249.95**

Video Monitors

HI-RES 12" GREEN - Zenith

15 MHz bandwidth, 700 lines/inch, P31 green phosphor, switchable 40 or 80 columns, small, light-weight & portable.

VDM-201201	*List price $150.00*	**$118.95**

Leedex / Amdek

Reasonably priced video monitors

VDM-801210	*Video 100 12" B&W* ..	**$139.95**
VDM-801230	*Video 100-80 12" B& W*	**$179.95**
VDM-801250	*12" Green Phospor*	**$169.95**
VDC-801310	*13" Color I*	**$379.95**

12" COLOR MONITOR - NEC

Hi-res monitor with audio & sculptured case

VDC-651212	*Color Monitor*	**$479.95**

12" GREEN SCREEN - NEC

20 MHz, P31 phosphor video monitor with audio, exceptionally high resolution - A fantastic monitor at a very reasonable price

VDM-651200	*Special Sale Price*	**$199.95**

Video Terminals

AMBER SCREEN - Volker Craig

Detachable keyboard, amber on black display, 7 x 9 dot matrix, 10 program function keys, 14 key numeric pad, 12" non-glare screen, 50 to 19,200 baud, direct cursor control, auxiliary bi-directional serial port

VDT-351200	*List $795.00*	**$645.00**

VIEWPOINT - ADDS

Detachable keyboard, serial RS232C interface, baud rates from 110 to 19,200, auxiliary serial output port, 24 x 80 display,

VDT-501210	*Sale Priced*	**$639.95**

TELEVIDEO 950

VDT-901250	*List $1195.00*	**$995.00**

DIALOGUE 80 - Ampex

VDT-230080	*List $1195.00*	**$895.00**

JADE
Computer Products

S-100 CPU Boards

THE BIG Z* - Jade

2 or 4 MHz switchable Z-80 CPU with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600*

CPU-30201K	*Kit*	**$139.95**
CPU-30201A	*A & T*	**$189.95**
CPU-30200B	*Bare board*	**$35.00**

2810 Z-80* CPU - Cal Comp Sys

2/4 MHz Z-80A CPU with RS-232C serial I/O port and on-board MOSS 2.2 monitor PROM, front panel compatible.*

CPU-30400A	*A & T*	**$269.95**

CB-2 Z-80 CPU - S.S.M.

2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300K	*Kit*	**$239.95**
CPU-30300A	*A & T*	**$299.95**

S-100 PROM Boards

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer w/software

MEM-99520K	*Kit*	**$189.95**
MEM-99520A	*A & T*	**$249.95**

PB-1 - S.S.M.

2708, 2716 EPROM board with built-in programmer

MEM-99510K	*Kit*	**$154.95**
MEM-99510A	*A & T*	**$219.95**

EPROM BOARD - Jade

16K or 32K uses 2708's or 2716's, 1K boundary

MEM-16230K	*Kit*	**$79.95**
MEM-16230A	*A & T*	**$119.95**

S-100 Video Boards

VB-3 - S.S.M.

80 characters x 24 lines expandable to 80 x 48 for a full page of text, upper & lower case, 256 user defined symbols, 160 x 192 graphics matrix, memory mapped, has key board input.

IOV-1095K	*4 MHz kit*	**$349.95**
IOV-1095A	*4 MHz A & T*	**$439.95**
IOV-1096K	*80 x 48 upgrade*	**$39.95**

VDB-8024 - SD Systems

80 x 24 I/O mapped video board with keyboard I/O, and on-board Z-80A.*

IOV-1020A	*A & T*	**$459.95**

VIDEO BOARD - S.S.M.

64 characters x 16 lines, 128 x 48 matrix for graphics, full upper/lower case ASCII character set, numbers, symbols, and greek letters, normal/reverse/blinking video, S-100.

IOV-1051K	*Kit*	**$149.95**
IOV-1051A	*A & T*	**$219.95**
IOV-1051B	*Bare board*	**$34.95**

S-100 Motherboards

ISO-BUS - Jade

Silent, simple, and on sale - a better motherboard

6 Slot (5¼" x 8⅝")

MBS-061B	*Bare board*	**$19.95**
MBS-061K	*Kit*	**$39.95**
MBS-061A	*A & T*	**$49.95**

12 Slot (9¾" x 8⅝")

MBS-121B	*Bare board*	**$29.95**
MBS-121K	*Kit*	**$69.95**
MBS-121A	*A & T*	**$89.95**

18 Slot (14½" x 8⅝")

MBS-181B	*Bare board*	**$49.95**
MBS-181K	*Kit*	**$99.95**
MBS-181A	*A & T*	**$139.95**

S-100 RAM Boards

MEMORY BANK - Jade

4 MHz, S-100, bank selectable, expandable from 16K to 64K

MEM-99730B	*Bare Board*	**$49.95**
MEM-99730K	*Kit no RAM*	**$199.95**
MEM-32731K	*32K Kit*	**$239.95**
MEM-64733K	*64K Kit*	**$279.95**
Assembled & Tested		add **$50.00**

64K RAM - Calif Computer Sys

4 MHz bank port / bank byte selectable, extended addressing, 16K bank selectable, PHANTOM line allows memory overlay, 8080 / Z-80 / front panel compatible.

MEM-64565A	*A & T*	**$575.00**

64K STATIC RAM - Mem Merchant

64K static S-100 RAM card, 4-16K banks, up to 8MHz

MEM-64400A	*A & T*	**$789.95**

32K STATIC RAM - Jade

2 or 4 MHz expandable static RAM board uses 2114L's

MEM-16151K	*16K 4 MHz kit*	**$169.95**
MEM-32151K	*32K 4 MHz kit*	**$299.95**
Assembled & tested		add **$50.00**

16K STATIC RAM - Mem Merchant

4 MHz 16K static RAM board, IEEE S-100, bank selectable, Phantom capability, addressable in 4K blocks, "disable-able" in 1K segments, extended addressing, low power

MEM-16171A	*A & T*	**$164.95**

S-100 Disk Controllers

DOUBLE-D - Jade

Double density controller with the inside track, on-board Z-80A, printer port, IEEE S-100, can function on an interrupt driven buss*

IOD-1200K	*Kit*	**$299.95**
IOD-1200A	*A & T*	**$375.00**
IOD-1200B	*Bare board*	**$59.95**

DOUBLE DENSITY - Cal Comp Sys

5¼" and 8" disk controller, single or double density, with on-board boot loader ROM, and free CP/M 2.2 and manual set.*

IOD-1300A	*A & T*	**$374.95**

S-100 I/O Boards

S.P.I.C. - Jade

Our new I/O card with 2 SIO's, 4 CTC's, and 1 PIO

IOI-1045K	*2 CTC's, 1 SIO, 1 PIO*	**$179.95**
IOI-1045A	*A & T*	**$239.95**
IOI-1046K	*4 CTC's, 2 SIO's, 1 PIO*	**$219.95**
IOI-1046A	*A & T*	**$299.95**
IOI-1045B	*Bare board w/ manual*	**$49.95**

I/O-4 - S.S.M.

2 serial I/O ports plus 2 parallel I/O ports

IOI-1010K	*Kit*	**$179.95**
IOI-1010A	*A & T*	**$249.95**
IOI-1010B	*Bare board*	**$35.00**

S-100 Mainframes

MAINFRAME - Cal Comp Sys

12 slot S-100 mainframe with 20 amp power supply

ENC-112105	*Kit*	**$329.95**
ENC-112106	*A & T*	**$399.95**

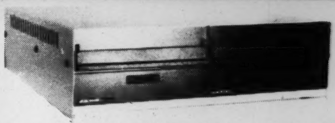
DISK MAINFRAME - N.P.C.

Holds 2 8" drives and a 12 slot S-100 system. Attractive metal cabinet with 12 slot motherboard & card cage, power supply, dual fans, lighted switch, and other professional features

ENS-112325	*with 25 amp p.s.*	**$699.95**

CIRCLE 199 ON READER SERVICE CARD

Disk Drives



Handsome metal cabinet with proportionally balanced air flow system. • Rugged dual drive power supply • Power cable kit • Power switch, line cord, fuse holder, cooling fan • Never-Mar rubber feet • All necessary hardware to mount 2-8" disk drives, power supply, and fan • Does not include signal cable

Dual 8" Subassembly Cabinet

END-000420	*Bare cabinet*	**$59.95**
END-000421	*Cabinet kit*	**$225.00**
END-000431	*A & T*	**$359.95**

8" Disk Drive Subsystems
Single Sided, Double Density

END-000423	*Kit w/2 FD100-8Ds*	**$924.95**
END-000424	*A & T w/2 FD100-8Ds*	**$1124.95**
END-000433	*Kit w/2 SA-801Rs*	**$999.95**
END-000434	*A & T w/2 SA-801Rs*	**$1195.00**

8" Disk Drive Subsystems
Double Sided, Double Density

END-000426	*Kit w/2 DT-8s*	**$1224.95**
END-000427	*A & T w/2 DT-8s*	**$1424.95**
END-000436	*Kit w/2 SA-851Rs*	**$1495.00**
END-000437	*A & T w/2 SA-851Rs*	**$1695.00**

QUME DT-8

8" Double-Sided, Double-Density Disk Drive

1 Drive	**$524.95 each**
2 Drives	**$499.95 each**
10 Drives	**$479.95 each**

Jade Part Number MSF-750080

Shugart 801R

8" Single-Sided, Double-Density Disk Drive

1 Drive	**$394.95 each**
2 Drives	**$389.95 each**

Jade Part Number MSF-10801R

SIEMENS 8"

8" Single-Sided, Double-Density Disk Drive

1 Drive	**$384.95 each**
2 Drives	**$349.95 each**
10 Drives	**$324.95 each**

Jade Part Number MSF-201120

MPI B-51

5¼" Single-Sided, Double-Density Disk Drive

1 Drive	**$234.95 each**
2 Drives	**$224.95 each**
10 Drives	**$219.95 each**

Jade Part Number MSM-155100

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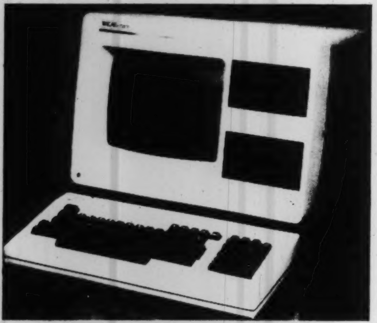


WICAT Systems, Inc. has announced the WICAT System 150 Micro Workstation.

The system has an MC68000 processor which runs at 8MHz, and although it has a 16-bit external data path, the processor has 32 internal bit registers and supports 32-bit operations. Memory sizes range from 256KB of dynamic RAM up to 1.5 MB.

Mass storage includes a 10MB 5 1/4" Winchester-based drive and a 5 1/4" floppy disk drive for back-up purposes. The standard system has two RS-232C serial interfaces and a parallel interface to support peripherals.

The System 150 also supports UNIX/V7 and CP/M emulator optional operating systems, and Pascal, C, APL, Ada, Cobol, Fortran, Lisp, WBasic and Assembler.

WICAT Systems, 1875 South State St., Orem, UT 84057. (801)224-6400.

CIRCLE 351 ON READER SERVICE CARD

PERIPHERALS

New Computer-To-Videodisc Interface

Symtec has announced three Videodisc Control Cards for optical videodisc users. All three control cards are configured for Apple computer control.

The Pioneer Control Card is a one way communication device that plugs into the remote control jack in the back of the player. It will obey any and all commands built into the player.

The DVA Control Card will interface with the DVA-2, DiscoVision player, for 8-bit parallel bi-directional communication.

The Sony Control Card interfaces with an RS-232 serial format on the back of the player and is bi-directional. This card will also interface to other RS232 devices like the 7820-1 and -3 Videodisc players.

All three cards have a built-in software controlled video switch to switch from the Apple monitor to the viewing screen which will allow you to operate with one monitor.

Symtec, Inc., P.O. Box 462, Farmington, MI 48024.

CIRCLE 352 ON READER SERVICE CARD

Apple Paddle Port Expansion

The Joyport from Sirius Software provides expansion of the Apple game paddle port to allow the use of four paddles (with all buttons functional) or two Atari-type joysticks.

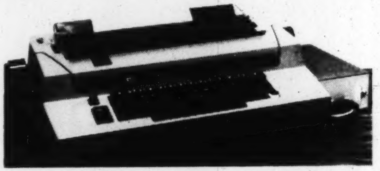
Two 16-pin sockets to accept standard Apple style paddles, joysticks or other devices are designed to operate from the Apple game port.

Sirius Software Inc., Joyport 2011 Arden Way, #2, Sacramento, CA 95825.

CIRCLE 353 ON READER SERVICE CARD

TERMINALS & I/O

Printer Interface for IBM Typewriter



The ELF 2 Interface unit from Ipex International allows the use of IBM electronic typewriter Models 50, 60, and 75 as letter quality printers by providing an RS-232C serial or Centronics-compatible parallel printer interface which can be connected to the user's computer.

All electrical connections between the interface and the typewriter are made with IBM-compatible plug-in connectors, and complete, illustrated, step-by-step instructions are provided.

The ELF 2 Interface accepts standard ASCII data from the user's computer. $495.

Ipex International Inc., 5115 Douglas Fir Rd., Calabasas, CA 91302. (213)710-1444.

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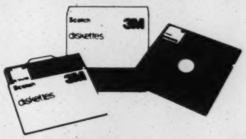

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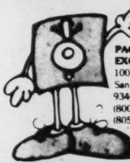

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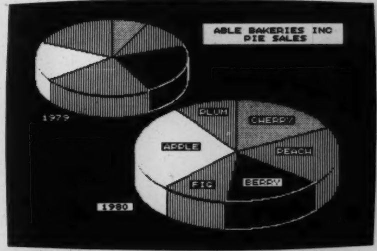

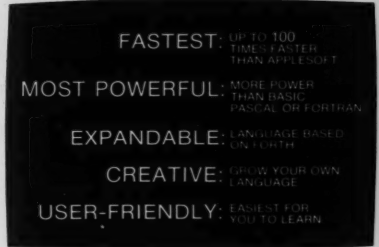

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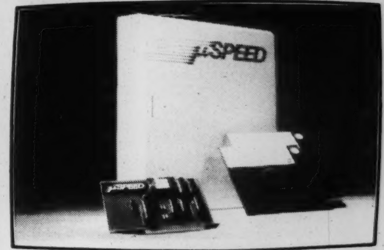

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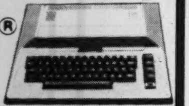

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New Products, continued...

Voice Entry for Apple

Scott Instruments announces Shadow/VET, a voice entry terminal which interfaces directly with any Apple II computer.

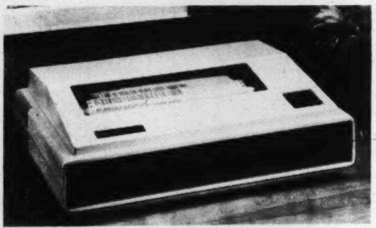
It enables the user to run Integer Basic, Applesoft, machine-code and Pascal programs by voice input with no modifications to the programs.

The Shadow/VET is supplied with preprocessor, interface board with 16K onboard RAM memory, software, noise-cancelling headset microphone, and operator's manual. $995.

Scott Instruments, 1111 Willow Springs Dr., Denton, TX 76201. (817)387-9514.

CIRCLE 355 ON READER SERVICE CARD

New Dot Matrix Printer By Heath



A dot matrix line printer—the H-25—has been added to the Heath/Zenith line of microcomputer peripherals.

The bi-directional H-25 prints at speeds in excess of 150 characters per second, and up to 300 lines per minute. It interfaces with most standard microcomputer systems using an RS-232C Serial Interface, or a 20 mA current loop.

The character set of the printer has all 95 ASCII characters, upper and lower case, and 33 graphics characters. Character width, or pitch, may be selected by the operator from 10, 12, 13.2 or 16.5 characters per inch. The printer forms characters with a 9 x 9 dot matrix. $1095.

Heath Company, Dept. 350-315, Benton Harbor, MI 49022.

CIRCLE 356 ON READER SERVICE CARD

I/O Subsystem for Atari

California Microlink Corporation announces Easy I/O, a product designed to eliminate the cumbersome interfacing of parallel and serial I/O to the Atari 800 computer.

Cabling and software handlers are available for popular line printers. The software handlers (in the form of AUTORUN.SYS files) are user transparent and compatible with Atari language cartridges. $175.

California Microlink Corp., 2078-C Walsh Ave., Santa Clara, CA 95050. (408)988-6437.

CIRCLE 357 ON READER SERVICE CARD

NEC Introduces Dot Matrix Printer

NEC Home Electronics, USA, announces a dot matrix printer with a standard parallel interface. Although the printer rounds out NEC's PC-8000 Series Microcomputer System as an integrated component, company officials say that other computer systems will constitute a significant portion of its market.

At 100 characters per second, the PC-8023A printer can bidirectionally print the upper and lower case ASCII, plus numerous Greek, mathematical and graphic symbols. In addition, a special feature of the printer is its ability to print dot graphic screens on paper. The unit uses either cartridge or ribbon spools. $795.

NEC Home Electronics USA, Personal Computer Division, 1401 Estes Ave., Elk Grove Village, IL 60007. (312)228-5900.

CIRCLE 358 ON READER SERVICE CARD

Touch Panel Color Monitor

The International Institute of Applied Technology, Inc. announces an integrated Touch Panel and Color Monitor for use on the Apple II.

IIAT will offer the integrated Touch Panel, Color Monitor, and Apple II Interface Card for $1,399. An optional Interface for a DiscoVision Associates Model II Player is available for $150. The interface includes software drivers and a video switch for selecting the Apple II graphics output or the videodisc for display on the Color Monitor. The Videodisc Controller is available separately for $400.

International Institute of Applied Technology, Inc., 20010 Century Blvd., Germantown, MD 20767. (301)428-9010.

CIRCLE 359 ON READER SERVICE CARD

Seven-Color Printer

D.N. Computer Services Ltd. announces the CX80 Color Printer, a seven-color dot matrix printer.

A software instruction is used to call up each of the seven colors as required. The CX80 Color Printer has built in 96 ASCII plus 64 graphic characters as standard and the user can program up to 15 of his own characters. The CX80 does not require special paper; normal white tractor feed paper is used.

A special Dump Card has been developed which enables the Apple computer to

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No two games, even at the same clock setting, are the same.

The advanced disk version allows more aircraft, and gives you four additional area maps, each with its own special challenges.

Air Traffic Controller is now available for the 16K TRS-80 (3006), for the 16K Apple II and Apple II plus (4008), and the 8K Sorcerer (5008). All are on cassette for **$11.95**.

Advanced Air Traffic Controller is available on diskette for the 32K TRS-80 (3518), the 16K Atari (7503), and the 32K Apple II and Apple II plus (4517) for **$19.95**, and on cassette for the 16K Atari (7004) and the 16K PET (called Sector 3) (1302) for **$14.95**.

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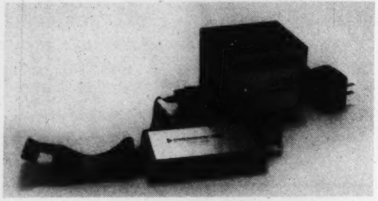
New Products, continued...

transfer direct from color screen to the printer. Interfaces are available for Apple and TRS-80.

D.N. Computer Services Ltd., West Croft Industrial Estate, Manchester Old Rd., Rhodes, Middleton, Greater Manchester M24 4PJ. England.

Card Readers for TRS-80 Model III



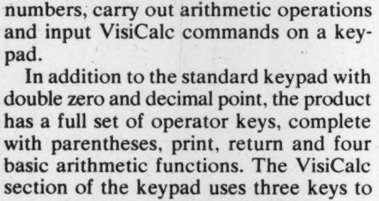
Chatsworth Data Corporation has announced a special interface to the TRS-80 Model III for its MR 500 and OMR 500 card readers. The interface plugs into the I/O bus jack of the Model III.

The card data can be in either the ASCII equivalent code or the image of the data. The MR500 uses an electric current technique for reading and, thus, can read only a soft pencil mark ($750), while the OMR 500 is an optical reader that not only reads marks made by many different pencils and pens, but can scan cards containing punches, pre-printed and mark sense data ($1095).

Chatsworth Data Corp., 20710 Lassen St., Chatsworth, CA 91311. (213) 341-9200.

CIRCLE 361 ON READER SERVICE CARD

Numeric Keypad For Apple



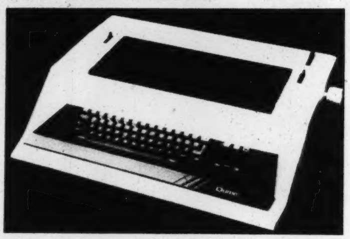
The Keyboard Company's Numeric Keypad allows Apple users to enter numbers, carry out arithmetic operations and input VisiCalc commands on a keypad.

In addition to the standard keypad with double zero and decimal point, the product has a full set of operator keys, complete with parentheses, print, return and four basic arithmetic functions. The VisiCalc section of the keypad uses three keys to control cursor movement. $149.95.

The Keyboard Company, 7151 Patterson Dr., Garden Grove, CA 92641. (714)891-5831.

CIRCLE 362 ON READER SERVICE CARD

KSR Printer Terminal



Qume Corporation has introduced a daisywheel data terminal.

The Sprint 9/35 keyboard send-receive (KSR) and receive only (RO) terminal prints at a speed of 35 cps.

The Sprint 9/35 offers the following features: universal linear power supply, selectable to permit operation in any international environment; "Clean Hands" Quickload cartridge system; and automatic proportional spacing, switch-selectable. $2100.

Qume, 2350 Qume Dr., San Jose, CA 95131. (408) 942-4000.

CIRCLE 363 ON READER SERVICE CARD

Memory and Video Modules for TRS-80

The Compactor I is a Memory Management Module that plugs into the TRS-80 Model III. It provides the capability of running the CP/M (2.2) operating system and zero origin stand-alone CP/M applications programs while still preserving the environment to run TRS-Basic and TRSDOS.

The Compactor IV is a dual purpose Video Display Module for the Model III. This module serves as an 80 x 24 video display and EIA Standard RS-232 serial interface. All necessary cables and instructions are included.

Compactors I and IV are priced at $450 and $475.

Hurricane Laboratories, Inc., P.O. Box 631, Cupertino, CA 95015. (408)446-0777.

CIRCLE 364 ON READER SERVICE CARD

DISK SYSTEMS

5 MB Winchester Drive for $3195

Konan Corporation has announced a 5 1/4" Winchester drive to the personal computer market.

Using the Seagate ST 506 the David Subsystem provides 5 megabytes of formatted storage in a box that measures 4.75" x 5.9" x 11.25".

The subsystem is now available with the host adapters for the Apple and S-100 Systems. $3195.

Konan Corporation, 1448 North 27th Ave., Phoenix, AZ 85021. (800)528-4563.

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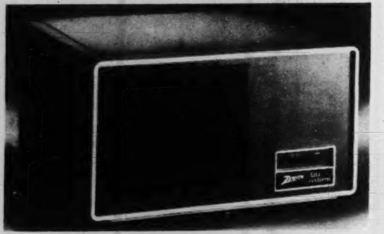
CIRCLE 222 ON READER SERVICE CARD

New Products, continued...

Winchester Disk for Zenith



An 8" Winchester disk drive with floppy disk back-up has been introduced by Zenith Data Systems for its business microcomputer systems.

The non-removable Winchester in the Z-67 increases the storage capacity of Zenith microcomputers to almost 10 million bytes, with the 8" floppy diskette back-up providing an additional million bytes. $5995.

Zenith Data Systems, 100 Milwaukee Ave., Glenview, IL 60025. (312)391-8181.

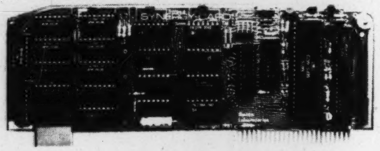
CIRCLE 366 ON READER SERVICE CARD

MEMORY

Synergy Card for Apple

The Synergy-Card from Spies Laboratories is a 16K RAM card capable of adding a parallel printer port (Centronics and Epson standard), a serial port (RS-232C), two interval timers, a real time clock/calendar, and a BSR X-10 interface to a 48K Apple II or Apple II Plus. It is compatible with Pascal, Fortran, CP/M, Pilot and VisiCalc.

The Synergy-Card with 16K RAm and instruction manual retails for $195. Option 1 adds the parallel port, serial port, and two interval timers with software (on disk) for $59. Parallel cable $30, serial cable $20. Option 2 requires option 1 and adds the real time clock/calendar for $49. Option 3 requires options 1 and 2, adding the BSR X-10 interface for $39.

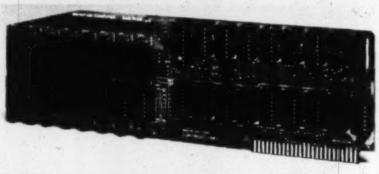


Spies Laboratories, P.O. Box 336, Lawndale, CA 90260. (213)644-0056.

CIRCLE 367 ON READER SERVICE CARD

16K RAM Card for Apple

Mountain Computer has released a new dual 16K RAM card for the Apple II. Two banks of 16K selectable RAM expand the Apple to 80K of available memory. The second bank of 16K RAM is controlled by user-supplied software. Hardware and/or software selection of each 16K bank of RAM is controlled by the user. The card also provides its own refresh circuitry.



The card is supplied with 16K of installed RAM for $189. The additional 16K of plug-in RAM costs $24.95. RAM diagnostics have been developed (on diskette) and are supplied with the product.

Mountain Computer Inc., 300 El Pueblo Rd., Scotts Valley, CA 95066. (408)438-6650.

CIRCLE 368 ON READER SERVICE CARD

32K RAM Card for Apple

Computer Technology Associates announces a 32K Apple II Memory Expansion Card.

The AXP-32K Apple memory card provides the Apple user with an additional 32K bytes of RAM organized in two pages of 16K.

The AXP-32K is compatible with Basic, Applesoft, Pascal, Microsoft Z80 Softcard, VisiCalc, Fortran, and Lisa Version 2.0. $274.95.

Computer Technology Associates, 118 Castellano, El Paso, TX 79912. (915)533-2108.

CIRCLE 369 ON READER SERVICE CARD

Color Computer Memory

Computerware has introduced a board that expands the memory of the Radio Shack Color Computer from 16K to 32K.

The 16 Plus is designed to allow the graphics display to reside anywhere within the 32K of memory. No software modifications are required for existing software and the 16 Plus makes the Color Computer completely compatible with anticipated disk systems. $84.95.

Computerware, Box 668, 1472 Encinitas Blvd., Encinitas, CA 92024. (714)436-3512.

CIRCLE 370 ON READER SERVICE CARD

MISCELLANEOUS

Apple Storage/Security System

With an Apple II inside and a monitor and disk drives on top, Station II from Trace Systems creates an integrated system which allows the user to get inside the Apple without unstacking and restacking peripherals. It also clears the work station of electrical cords and cables, because the Apple, monitor and another peripheral plug into built-in power outlets. One cord and one wall plug power the system.

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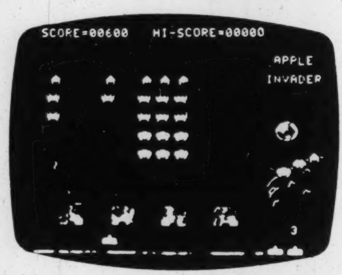

Super Invader features superb high-resolution graphics, nail-biting tension and hilarious antics by the moon creatures.

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CIRCLE 195 ON READER SERVICE CARD

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Employment expense deduction, maximum medical expense deduction, all personal exemptions, age exemption for those qualifying, detailed tax calculation, dividend tax credit, Federal and Provincial tax payable, and much more.

Directs the user on a line by line basis, indicating where amounts are filled in on the return and where attachments are required.

Written by a Chartered Accountant, the program was tested on personal tax returns prepared in a public accounting office.

Available on cassette for TRS-80 Model I Level II-16K and Model III. Disk add $5.00.

Standard Program $19.95

Self-employment Program $29.95

Alta., Sask., Man. residents add $5.00
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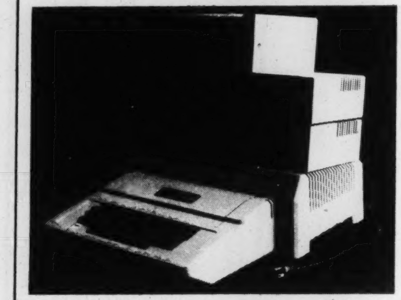
CIRCLE 231 ON READER SERVICE CARD

New Products, continued...



With Station II secured to a desk, the Apple can be locked inside with a key. With this key, the Apple, monitor, and another peripheral can be powered up at once, and locked on or off.

Trace Systems, 1928 Old Middlefield Way, Mountain View, CA 94043. (415)964-3115.

CIRCLE 371 ON READER SERVICE CARD

TRS-80 Cabinet

The Organizer places TRS-80 Model 1 components into one desktop package to hide wires and cables.

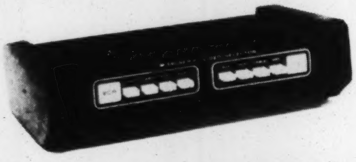
The Organizer consists of two wood grain cabinets: Cabinet one holds the monitor, expansion interface, power supplies, line filters, cables, power strip and fan.

Cabinet two holds up to four disk drives, a tape recorder, fan, diskettes and cassettes. $87.50.

Designatron, 2794 Hume Rd., Malibu, CA 90265. (213)456-9023.

CIRCLE 372 ON READER SERVICE CARD

Video Selector

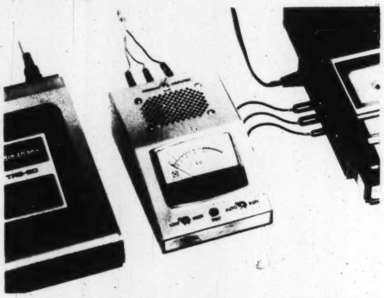


Radio Shack offers a pushbutton video switching and control center, designed to eliminate the bother of repeatedly changing cable connections.

The Archer Video Selector simplifies signal routing with complex home video systems. The banks of pushbuttons provide all necessary switching and signal routing between four 75 Ohm coax inputs and one phono jack to three 75 Ohm coax outputs. $79.95.

Available at Radio Shack stores and participating dealers.

Meter Monitors Cassette Loading



Dynametric Newport has developed the AVM-1 Loadstat for assuring the successful loading and saving of cassette tape programs.

The AVM-1 features both an audio-VU meter and an internal speaker. The unit draws its power from the CTR-80A and CTR-41 recorders and patches the recorder to the computer.

The AVM-1 displays the audio level from any cassette program, regardless of manufacturer and quality of original recordings so the user can adjust the record/playback level for program loading or recording.

Dynametric Newport, 524 Seaward Rd., Corona Del Mar, CA 92625.

CIRCLE 373 ON READER SERVICE CARD

Reserve Power Supply for Apple

The APS-5 Reserve Power Supply provides back-up power for the Apple II during prolonged power outages and brownouts. When the power fails, visual, audible and electronic signals alert the user while the unit provides instantaneous back-up power.

In addition to providing one hour and forty-five minutes of support time, the APS-5 has automatic turn-on, automatic recharging of its batteries, automatic cutoff to prevent deep battery discharge, low battery indicator, and a steel case for improved RFI/EMI suppression. $389.95.

Also available with the APS-5 is an optional APS-5DC adapter which allows connection of the computer through the APS-5DC to *any* external 12v DC power source (i.e. car cigarette lighter, batteries, etc.)

Control Technology, Inc., 8200 N. Classen Blvd., Suite 101, Oklahoma City, OK 73114. (405) 840-3163.

CIRCLE 374 ON READER SERVICE CARD

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Gavin Computers—5935 W. Addison St., Chicago 60634; (312) 286-4232. Mon.-Thurs. 9-8:30, Tues.-Sat. 9-6. Apple B & H, Atari & Commodore Systems.

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Science Fantasy Bookstore—18 Eliot St., Harvard Sq., Cambridge 02138; (617) 547-5917. 11-8 Thur. Apple, Atari & TRS-80 games; Epyx, Microsoft, Creative Computing.

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Computer Center—Garden City; (313) 425-2470 & West Bloomfield; (313) 855-4220; Books, Magazines, Hardware and Software for Apple, North Star, TRS-80 & PET.

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Computernook—Rt. 46, Pine Brook Plaza, Pine Brook 07058; (201) 575-9468. 10-6:30 MTWS, 10-8 Thurs., Fri. Apple/Commodore Authorized dealer.

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Abacus II—1417 Bernath Pkwy., Toledo 43615; (419) 865-1099. 10-6, 10-7 Thurs. Apple, Osborne, Adds, NEC, Atari, Epson & IDS Printers.

Barnhart Stores—Urbana; (513)653-7257. 8am-5pm. Atari Computers at MAIL ORDER prices/Authorized Atari Service Center.

Micro Mini Computer World—74 Robinwood Ave., Columbus 43213; (614) 235-5813/6058. 11-7 Tues.-Sat. Authorized Apple/Commodore dealer. Sales, Service, Business Software.

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No Place Left To Go

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"I haven't seen one of these years. I learned on a PET just like this. Same dinky keypad and everything. . . ."

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Getting Acquainted With Your VIC20

Getting Acquainted With Your VIC20 by Tim Hartnell leads the reader, step by simple step, from the absolute basics of programming the VIC to writing complex, sophisticated programs. It thoroughly describes use of the sound, music and color graphics capabilities and illustrates the use of these functions in over 60 programs and games.

By following the comprehensive explanation given for each program and computer function, the reader will learn a great deal about the VIC, the Basic language and microcomputers in general.

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This book is a worthwhile resource and will help the reader make the most of his computer. The reader will never feel quite the same about it after surviving a round of FRENZY, or listening to the VIC20 compose a 'symphony'.

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eviews...book r

Stephen B. Gray

Nailing Jelly To a Tree by Jerry Willis and William Danley Jr. Dilithium Press, Box 606, Beaverton, OR 97075. 250 pages, paperback $12.95. 1981.

The odd title, which gives no clue that this is a book about software, was chosen because "learning about software is a lot like nailing jelly to a tree," according to the preface. "Software is nebulous, and difficult to get a firm grasp on."

The first two chapters cover an introduction and computer numbering systems. A chapter on monitors and operating systems is followed by two on machine language and TRS-80 assembly language. Three chapters on Basic include two on the language and one on converting from one Basic to another. The last chapter provides a glossary and specifics on converting various Basic statements.

The emphasis is not on learning to write programs, according to the back cover, but "on learning to use the thousands of available programs that have already been written." More specifically, according to the first chapter, the book helps you use the programs you may find "in a magazine, or anywhere else for that matter...written for a particular computer, often not yours. That means it will require some modifications before it works at your house. Being able to modify, enhance, change and experiment with all the free and inexpensive programs now available requires a significant amount of software expertise.... Using someone else's programs lets you have the enjoyment of working with the computer without all the brain-warping drudgery involved in writing a lengthy program."

Although most computerniks will argue that such "drudgery" enchants and enhances the brain rather than warps it, this book should be useful to beginners needing a guide through the often mystifying world of software. The book is packed with valuable information and is very well written.

Problem-Solving Principles For Basic Programmers: Applied Logic, Psychology, and Grit by William E. Lewis. Hayden Book Company, Rochelle Park, NJ. 173 pages, paperback $9.95. 1981.

This book, which also comes in Fortran, Pascal and Interlingua versions at the same price, "consists of three interwoven conceptual threads: general problem-solving, program problem-solving, and the influences of psychology on the overall problem-solving process," according to the back cover.

The first chapter provides a Framework for Problem Solving by introducing the basic building blocks and some of the psychological influences involved. The next two consist of basic and advanced problem-solving prescriptions, such as "step back and view the forest" and "beware of anxiety — it's heavy."

Chapter Four, on Solving Larger Problems, looks into tree structures and the top-down process. Chapter Five, on Debugging, applies many of the problem-solving techniques discussed in previous chapters, and provides 16 more prescriptions, such as "determine if the bug is consistent" and "fish for the bug with hooks."

Lewis, a systems programmer for IBM in Arizona, has written a most helpful book that also teaches how to solve a few non-programming problems along the way. Although some of the prescriptions are exhortations to get your head straight, such as "beware of anxiety" and thus not as simple to apply as the concrete examples provided, they're all necessary to the author's principle of providing all the help he can, in a book that seems to be unique.

If you believe that programmers are born, not made, you'll be pleasantly surprised to find out just how much can be learned, especially from somebody who knows the score, and who knows how to teach.

Programs for Beginners on the TRS-80 by Fred Blechman. Hayden Book Co., Rochelle Park, NJ. 158 pages, paperback $8.95. 1981.

The title is somewhat misleading, even though the author "assumes you've had *no* past experience in either computers or programming but that you have a TRS-80 and the ...manual." In the next sentence, he says he's not going to teach you what Basic is, but how to use its essentials, and adds, "If Basic were a foreign language, this might be considered as a course in *conversational* Basic, not in Basic vocabulary, syntax, and grammar." On that basis, you'd be learning by rote, memorizing without fully understanding.

Anyway, the reader may be dead by page 4, so the author's assumptions may not matter. The first of the 21 programs is for Display Alignment. The display includes a border of graphic blocks, and page 4 says if you can't see all four corners, "remove the back of the display...leave the microcomputer on," and adjust the picture-tube centering tabs. Any TV repairman reading that would turn white, because even he would have to be very careful, and a beginner poking around a hot chassis is just asking for trouble.

Even though the 36-line first program has 14 RAM lines, the two-page explanation somehow gets into loops, print formats and blanking, which if not vocabulary, syntax or grammar, are what?

Perhaps this book is best considered as a collection of programs of some use to the *advanced* beginner. Well, a *very* advanced beginner, because the programs are fairly long, and not all that simple. There's a five-dog race, Bingo, and an on-screen digital clock, plus business programs such as creating an order form, light bookkeeping, and calculating loan interest. Other programs calculate long-distance phone charges, devise magic-square numbers, print a table of piano-keyboard frequencies, etc.

Hayden also offers a $10.95 cassette of all 21 programs, although you may find only a few useful, such as Bingo, phone toll-charge, interest calculation, invest or save, mortgage loan, and pay now or monthly. But you may not need them more than once or twice a year at most.

Granted, the point of the programs may be to teach specific statements and principles; each program description begins with a listing of what "you'll learn." These could be taught with much shorter and simpler programs, and more of them, and the title could be changed to truly reflect the nature of the book.

If you're an advanced beginner, or quite bright, there's much you can learn from this book, as long as you don't expect more than a couple of the programs to be of real use, and as long as you skip page 4.

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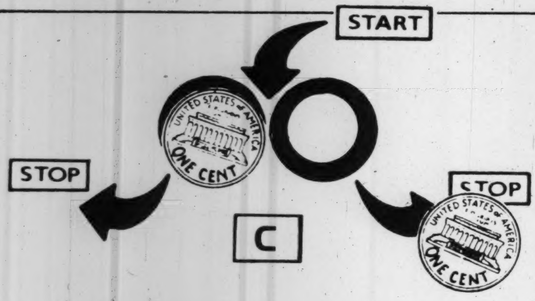

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eviews...book

Business System Buyer's Guide by Adam Osborne with Steven Cook. Osborne/McGraw-Hill, Berkeley, CA. 173 pages, paperback $7.95. 1981.

Unlike any other book written to help a businessman select a small computer, this one starts out with several horror stories. The first is about a man who bought a bargain computer, only to be told later he'd need 1,000 floppy disks to store his data.

This and four similar stories start off a book full of the helpful, outspoken information for which Adam Osborne has become famous, telling in a non-technical way how to acquire a small computer.

After the opening chapter with the horror stories come chapters on defining the problem, understanding computer systems, how to buy a computer (selecting vendors, looking for canned application programs, installing the system, etc.), after-sales support, and a summary of products.

That last chapter includes systems such as Apple, Atari, Commodore, Radio Shack, Altos, Cromemco, North Star, Pertec and Vector Graphics. A chart of comparative system prices shows the least expensive to be the Osborne 1. However, the book doesn't tout this machine anywhere near what it might; there are only two sentences on it in the text ("unique...size of a briefcase...very inexpensive...lot of free canned software") and four items in the nine-page table of applications software. However, two of the horror stories mention Osborne books.

None of which is meant to detract, however from a fine book that presents what may be the frankest discussion yet of exactly what small computer systems will and won't do for the small business. The style, unlike all those Osborne technical books, is very readable, and the book is easily understood by anyone with a little business experience.

How to Get the Most From Your Chess Computer by Julio Kaplan. R.H.M. Press, 417 Northern Blvd., Great Neck, NY 11021. 148 pages, paperback $8.95. 1980.

Published by a company that specializes in books for the chess player and written by an international master, this slim volume first describes how chess computers work, then how they can help you learn to play better, and ends with representative games.

Part I has six chapters, including three brief, slightly technical pages on the circuitry, twice that much on how the computer represents board positions, a discussion of tree-searching and such in How Computers Choose Good Moves, a look at The Various Types of Chess Programs in which several tree-searching strategies are examined, ending with two chapters on the strength (consistency) and weaknesses (inability to see beyond the horizon) of computer play.

The nine chapters of Part II deal with Learning Chess With the Computer, Beyond the Basics, Strategy, Tactics, Opening Traps, Endgame Play, Attacking the King, Giving Odds, and How to Beat the Computer. The advice in that last chapter includes: be on the alert for tactical tricks; keep the game quiet; when in difficulties try to trade pieces; and develop your attack slowly.

Part III consists of a single chapter that presents 15 computer games, with players such as Sargon 3, Mychess, Blitz 6.9, Belle, Chess 4.9, Kaplan, and other humans and machines.

The notation used is not the descriptive system (P-K4) used for so many years, but algebraic: a grid-reference system. Rather than use the long algebraic form (e2-e4), the book uses the short form (e4), which names only the arrival square. Computerniks should have no trouble.

This book is highly informative, written in an informal yet authoritative style; if you're into computer chess, buy it.

The Basic Handbook: An Encyclopedia of the Basic Computer Language by David A. Lien. CompuSoft Publishing, 1050-E Pioneer Way, El Cajon, CA 92020. 480 pages, paperback $19.95. Second edition, 1981.

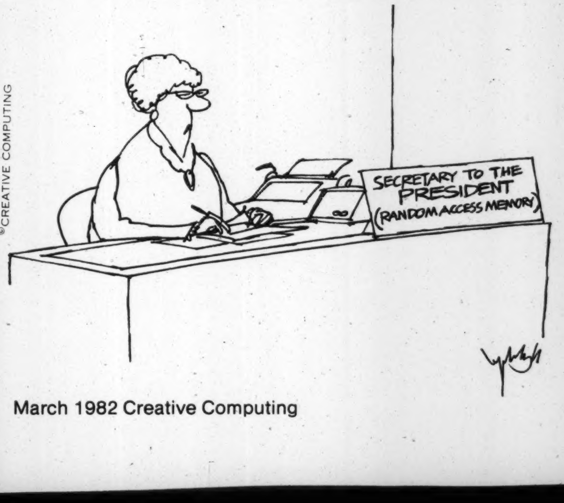
First published in 1978, the second edition of this book is exactly one-third longer (and costs one-third more) than the first, and introduces 236 additional words, "bringing the total to almost 500," as the back cover put it, adding, "Virtually every significant Basic word used by virtually every Basic-speaking computer in the world is explained."

The preface to the first edition said it addressed the problem of transporting programs between different computers by "discussing in detail every commonly used Basic Statement, Function, Operator and Command." The preface to the second says "special attention was given to documenting the diverse Basics implemented on the many new computers introduced (and about to be introduced) from Europe and Asia."

The format is the same: for every word, a description is given, along with a test program and sample run using the word, variations (if any) in usage of the word, and a list of related words. Again, many words have a section on "If your computer doesn't have it," which "gives alternate ways to accomplish the same objective using other Basic words, when possible...and it isn't always possible."

The second edition now includes five pages on what this book may be most helpful for: converting programs from one computer to another. Also new are 40 pages on the non-standard Basic used in the British Acorn Atom, on the special Basic words used by the Atari 400 and 800, Tektronix 4050 series, TRS-80 Color Computer, and Disk Basic, and an 18-page "index," which is also a "scorecard" for your computer. It lists the several hundred words for you to test, to find if the word is accepted by your machine.

This book, which is still the only one available to help software fans convert "foreign" programs for use on their own computers, is a remarkable achievement that surely nobody else will try to imitate.



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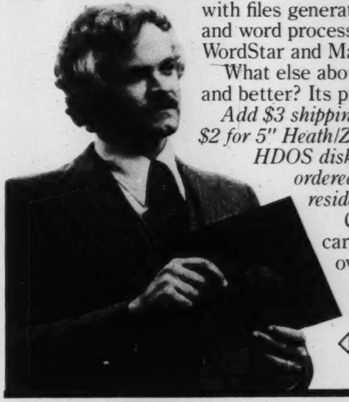

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puzzle answers

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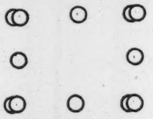
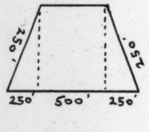


A "Star" Attraction: (1) Jump 5 to 8, remove 7. (2) Jump 2 to 5, remove 4. (3) Jump 9 to 2, remove 6. (4) Jump 10 to 6, remove 8. (5) Jump 1 to 4, remove 2. (6) Jump 3 to 7, remove 4. (7) Jump 5 to 8, remove 7. (8) Jump 6 to 10, remove 8.

The Pig To Sty Puzzle: PIG, WIG, WAG, WAY, SAY, STY.

The Misplaced Decimal: 7.3.

A Problem In Acreage: George would get nothing for his money. Using the dimensions given there are zero square feet in the plot. The drawing is obviously out of proportion to the dimensions.

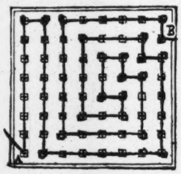


The sides have to be longer than 250 feet or there would be no distance between the 500 foot side and the 1000 foot side.

A Simple Substitution:

$$\begin{array}{r} 1865 \\ -\ 938 \\ \hline 927 \end{array}$$

The Switchboard Puzzle: The diagram below shows how the board may be wired from *B* to *A* with 233 inches of wire.



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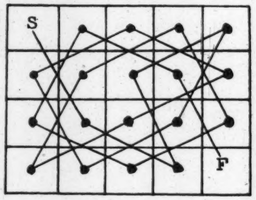

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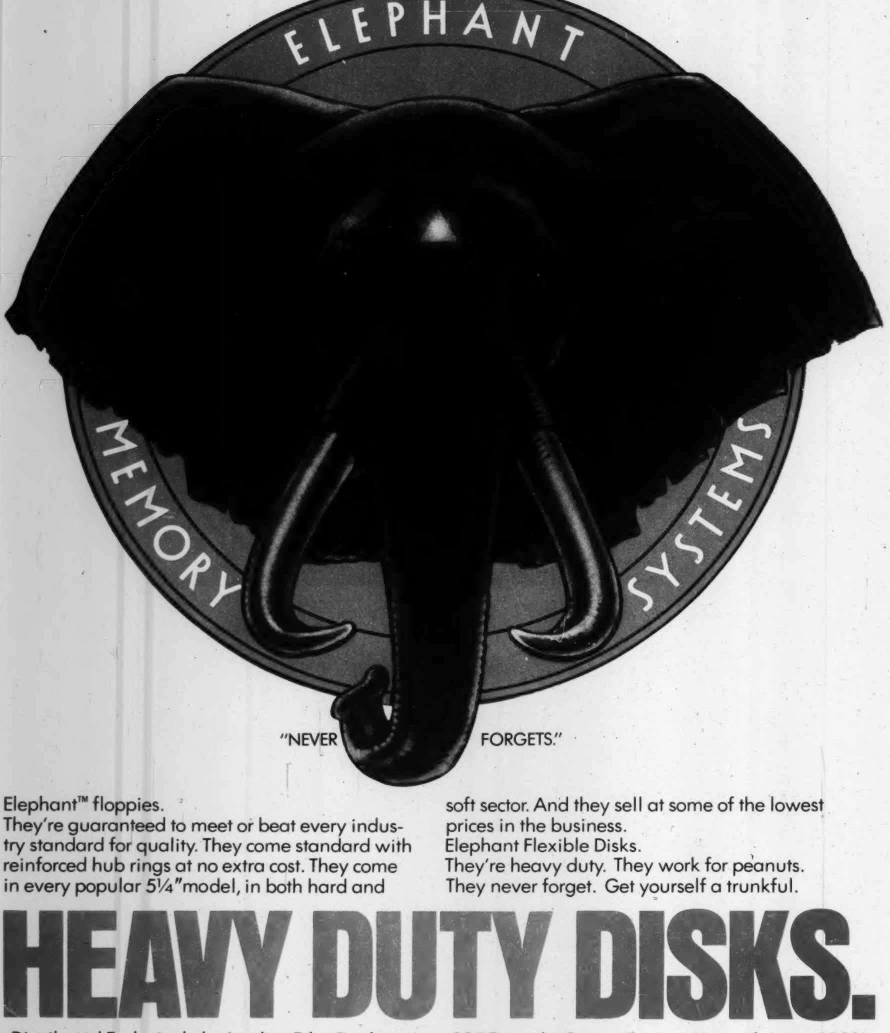

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